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An Expansion of the Virtual Training Program: History and Lessons Learned

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BDM Federal, Inc.

January 1997

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This report describes the "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)" Project, a follow-on effort to the "Simulation-Based Multiechelon Training Program for Armor Units (SIMUTA)" Project. The purposes of the project were to: (a) implement and validate the structured simulation-based training development methodology derived during the SIMUTA Project, (b) expand the U.S. Army Armor Center's Virtual Training Program (VTP) exercise library, and (c) revise portions of the VTP's original training support package. The report first describes the VTP initiative and identifies the SIMUTA-B Project objectives. It then describes the project's design phase, formative evaluation effort, and development phase. The design phase section covers the processes of identifying training objectives and composing the mission scenario. The formative evaluation section identifies the evaluation strategy and methodology, and the product testing schedule. The development section provides highlights of development activities and accomplishments. The final section presents lessons learned for use in future development efforts.

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FOREWORD

The U.S. Army's Active and Reserve Components face the challenge of training under ever-increasing time and resource limitations. In Fiscal Year 1993, Congress responded to this challenge by providing research and development funding for the establishment of a Reserve Component Virtual Training Program at Fort Knox, Kentucky. In November 1994, the Army renamed the program the Virtual Training Program (VTP) due to increasing usage by the Active Component.

The original VTP was developed through a contract effort entitled "Simulation-Based Multiechelon Training Program for Armor Units (SIMUTA)." The program provided structured, compressed training making innovative use of available simulation technologies. The training audience included armor, mechanized infantry, and scout platoons; armor companies and company teams; cavalry troops; armor battalions and battalion task forces on the Simulation Networking system; and battalion staffs in Janus. The "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)" Project expanded the training provided by increasing the number of exercises available. It also upgraded portions of the original VTP's training support package (TSP).

This Research Report documents and discusses the lessons learned during the design, development, and formative evaluation of the exercises and TSPs created during the SIMUTA-B Project. Discussions of the project's background and product design and development activities explain the SIMUTA-B context within which the lessons were learned. The exercises and TSPs, including the SIMUTA-B expansion products, have been provided to the VTP Observer/Controller Team of the 16th Cavalry Regiment at Fort Knox, as well as to trainers at Army National Guard training sites in Idaho and Georgia. Developers and implementers of structured simulation-based training (SST), along with the proponents and sponsors of such training, will find this report useful in guiding the development, implementation, and expansion of SST programs.

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Dr. Billy L. Burnside of the Army Research Institute for the Behavioral and Social Sciences (ARI) - Armored Forces Research Unit (AFRU) served as the Contracting Officer's Representative and superbly guided the developer's efforts. In addition the project steering committee, which included Dr. Barbara A. Black (Chief, ARI-AFRU), Colonel (COL) Paul E. Lenze (Chief of Staff, U.S. Army Armor School), COL Jerry L. Veach and Lieutenant Colonel Randall F. Williams (Army National Guard [ARNG] Special Assistant to the Commanding General, U.S. Army Armor Center), COL Steven L. Funk (Advanced Research Projects Agency [ARPA]), COL George L. Hargrove, and COL Randall E. Krug (ARPA Simulation in Training for Advanced Readiness Program Manager), kept the project on a focused, audience-oriented course.

Members of the Virtual Training Program Observer/Controller (O/C) Team at Fort Knox were instrumental in providing significant feedback during the development process and in the implementation of the program elements. Of particular note were Captain (CPT) Evan L. Brown and CPT Mark S. Lambert, who were instrumental in the creation and testing of the company and platoon level training, Major Dane K. Reves, who led the O/C Team effort in reviewing the TSPs and testing the battalion level exercises, and CPT Jerome K. Hawkins, whose support for all of these efforts should be noted. Units of the ARNG were also involved in exercise trials; their participation is noteworthy and highly appreciated.

Finally, special thanks go out to the Janus site personnel (especially Sergeant First Class Charles O. Hagar) and to the Mounted Warfare Simulation Training Center (in particular Mr. Wesley P. Wilson), for their exceptional assistance and support for this project.

AN EXPANSION OF THE VIRTUAL TRAINING PROGRAM: HISTORY AND LESSONS LEARNED

EXECUTIVE SUMMARY

Research Requirement:

The "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)" Project was designed with two purposes in mind: research and development. The research-oriented requirements were to implement the structured simulation-based training (SST) development methodology (C. H. Campbell, R. C. Campbell, Sanders, Flynn, & Myers, 1995) created during the "Simulation-Based Multiechelon Training Program for Armor Units (SIMUTA)" Project and to compose a list of lessons learned from this implementation. The lessons learned were to facilitate the development of future SST.

The development-oriented portion of the project required the SIMUTA-B Team to expand the Virtual Training Program (VTP) exercise library of defense in sector (DIS) and movement to contact (MTC) training. They were to create new battalion staff, battalion task force, company team, and platoon exercises and training support package (TSP) sets for a deliberate attack (DATK) mission. Two versions of a battalion staff exercise were to be developed for the Janus constructive simulation system developed by the Advanced Research Projects Agency (ARPA), and one battalion task force exercise was to be developed for the Simulation Networking (SIMNET) virtual simulation system. At the company team and platoon echelons, the team was to develop sets of exercises derived from the DATK mission used in the battalion-level exercises. One set was to be developed for company teams, another for armor platoons, and a third for mechanized infantry platoons. The team was to conduct a formative evaluation of each exercise.

In addition to the production of exercises and TSPs, there were a number of requirements that moderated the intended nature and purposes of the exercises. First, developers were to create a DATK story line, and revise the MTC and DIS story lines, based on the divisional brigade story line produced under related projects. This requirement would necessarily lead to the construction of a continuing story line between the VTP DATK, MTC, and DIS missions, which represented the second requirement. Third, developers were to create a training strategy linkage between the ARPA Janus and SIMNET versions of the battalion-level exercises. The purpose was to produce exercises that were mutually supporting, in terms of tasks trained, therefore enhancing training transfer between exercises. The final requirement required generating an enhanced focus on the execution of combat service support (CSS) tasks at the battalion level. This requirement was identified in response to VTP participant comments that they should receive more training on CSS operations.

Procedure:

As stated above, the exercises were developed through implementing the SST development methodology (C. H. Campbell et al., 1995). The project was completed in two phases: design and development. In the design phase, activities included identifying doctrinal training objectives based on the requirements of the designated mission, designing the scenario, and creating exercise outlines in preparation for the development phase. During the development phase, project personnel conducted a series of exercise tryouts that represented the formative evaluation effort. The tryouts tested the exercises in four levels. The first two levels were represented by pilots conducted internally by the SIMUTA-B Team. These pilots focused on the capabilities of the simulations to support the scenarios, the derivation of technical simulation data needed to create the exercises, and the evaluation of tactical plans. The latter two levels, trials, tested the training in a realistic environment. The trials evaluated the training management structure, verified the tactical plan with the intended training audience, and tested the performance observation and feedback system.

Throughout the development process, the data obtained during the formative evaluation pilots and trials were examined by project personnel to improve the newly created exercises, to retrofit the appropriate existing TSPs, and to identify lessons learned.

Findings:

At the conclusion of the project, both the research- and development-oriented objectives had been achieved. In research efforts, developers had implemented and validated the SST development methodology (C. H. Campbell et al., 1995) as a generalizable method of developing SST. It is not idiosyncratic to the development effort in which it was conceived. The project also produced many lessons learned, some of which were implemented and tested during the course of the project.

The formative evaluation pilots and trials, in conjunction with VTP Observer/Controller (O/C) Team reviews of the training products, demonstrated the achievement of the development-oriented objectives, the foremost of which was to produce and refine the stipulated DATK training. In developing the DATK training, developers were able to create a realistic scenario continuance in the storylines of the DATK, MTC, and DIS exercises, revise the MTC and DIS exercises for intraprogram consistency, and create a training strategy linkage between simulations. The exercises were mutually supporting in terms of tasks trained. The goal of creating an enhanced focus on CSS was achieved to the extent that the exercises now provide an opportunity to practice such tasks. To do more may require the conduct of CSS tasks in preparation for, or in the early stages of an exercise.

During the course of the project, developers made other significant changes to the VTP as a result of both the SIMUTA and SIMUTA-B Project experiences. In revising the TSPs, the team developed a new volume organization that will facilitate future expansions of the VTP exercise library. In addition, they incorporated a structured writing style into the training instruction guides, and revised the original VTP Orientation Guide to prepare units for participation. The new writing style was judged by the VTP O/C Team to have improved the usability of the TSPs.

The revised Orientation Guide is currently untested. Finally, the team revised the VTP's battalion-level performance observation and feedback system. The new system represents a more systematic, and less cognitively demanding means of providing feedback to training units. Tryouts were unable to verify the efficacy of this system.

Utilization of Findings:

By providing a list of lessons learned during the project, developers have answered a number of important questions about the development of SST programs. The lessons focus on the following areas: acceptance of structured training within the U.S. Army, determining training program goals and objectives, administrative and team building issues, and development-related issues. The intended audience for the lessons includes: (a) training program developers; (b) training development team designers; (c) training program sponsors who allocate funding for training programs and dictate training program objectives and goals; (d) U.S. Army leadership; and (e) training implementers (e.g., the VTP O/C Team) who maintain and improve the quality of the programs, once implemented.

AN EXPANSION OF THE VIRTUAL TRAINING PROGRAM: HISTORY AND LESSONS LEARNED

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AN EXPANSION OF THE VIRTUAL TRAINING PROGRAM: HISTORY AND LESSONS LEARNED

INTRODUCTION

This report describes the project entitled "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)." The SIMUTA-B Project is most accurately described as an effort to expand and refine the U.S. Army Armor Center's Reserve Component Virtual Training Program (RCVTP), created through the "Simulation-Based Multiechelon Training Program for Armor Units (SIMUTA)" Project (Hoffman, Graves, Koger, Flynn, & Sever, 1995). The RCVTP satisfies the real training needs of Army armor units by providing structured simulation-based training (SST). In addition to being highly structured, the training employs an innovative "turn-key" approach to training that emphasizes mission execution. While initially designed for Reserve Component (RC) units, the program is now used by Active Component (AC) units as well. Hence, the RCVTP has been renamed the Virtual Training Program (VTP).

The primary purpose of this report is to describe the lessons learned during the SIMUTA-B Project to the military training development community. Most of the lessons are drawn directly from experience throughout the project. Therefore, the reader should be familiar with the development efforts, the project's achievements, and the problems encountered throughout the duration of the project. The report begins by introducing the reader to the project's background and objectives. It follows by providing an abbreviated project history that highlights areas in which lessons were learned. The report concludes with an in-depth review of the lessons learned during the project.

Background

In 1989, changes in Soviet policies and corresponding demands to reduce the proportion of the budget devoted to defense led the Army to initiate plans for major force reductions. In 1990, the Army proposed a Base Force plan establishing a mix of 12 active, 6 reserve, and 2 cadre reserve divisions. Because reserve units now constituted a much larger percentage of the Army's total armed forces, the readiness of reserve units became an issue of prime importance.

A fundamental problem in RC training is that there are only 12 weekends and one 15-day period of annual training (AT) each year, a total of 39 training days. Some of this time is devoted to administrative activities in preparation for and in support of training. Still, more time is consumed by travel because of the geographical distances between the locations of RC units and doctrinally appropriate training areas.

A second problem, equal in magnitude to the first, is that the RC is not as well resourced for training as are their AC counterparts. In operational terms, the RC forces do not have the financial resources to engage in large scale maneuvers. The results of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) project titled, "Determinants of Effective Performance of Combat Units at the National Training Center," demonstrated that maneuvering

combat vehicles in terrain of the size prescribed by doctrine was essential to effective training of combat forces (Keesling, Ford, & Harrison, 1994).

To address these problems, Congress directed that the Army and the U.S. Army National Guard (ARNG) establish a simulation-based training program utilizing the Simulation Networking (SIMNET) and Janus simulations at Fort Knox. In response, the SIMUTA Project, a contracted effort directed by ARI's Armored Forces Research Unit (AFRU) at Fort Knox, was established.

The VTP

The Congressionally-funded VTP, established at Fort Knox, Kentucky, provides innovative SST. The VTP addresses the following training program characteristics identified by Brown (1991): (a) compressing training, (b) distributing training, (c) modernizing training support, and (d) focusing on critical tasks. By achieving a focus on each of these goals, the VTP offers training that maximizes the benefits simulation provides to both RC and AC units. A summative evaluation of the program's effectiveness and utility has not been conducted as of this time, but indications of the program's effectiveness are available (Hoffman et al., 1995; Shlechter, Bessemer, Nesselroade, & Anthony, 1995).

The VTP is implemented by a dedicated cadre of observer/controller (O/C) personnel. Prior to a unit's rotation, VTP O/Cs provide the unit with advance materials that orient participating units to the VTP and to the specific exercises they will execute. The advance materials include operations order (OPORD) materials for battalion exercises, OPORD narratives for company team and platoon exercises, and task-specific training information. This allows units to focus on execution rather than on planning and preparation while at the training site; that is, they can maximize their time in the simulations. Once units are on site, O/Cs provide a final orientation to the training, monitor the execution, and provide feedback during frequent after action review (AAR) sessions. After the training is completed, the O/Cs provide a take-home package (THP) for future reference.

The VTP immerses units in intensive practice of combat skills using SIMNET (Alluisi, 1991; U.S. Army Armor School, 1989) and a version of the Janus[1] system (U.S. Army Combined Arms Center, 1994) developed by the Advanced Research Projects Agency (ARPA). These technologies are used by the VTP to create realistic battlefield environments where units perform against purposeful threat forces. The original VTP exercises were built around typical missions conducted at the National Training Center (NTC): a movement to contact (MTC) and a defense in sector (DIS) for armor battalions and task forces.

The Original VTP Exercise Library

The VTP exercises utilize critical combat tasks derived from current Field Manual (FM) and Army Training and Evaluation Program (ARTEP) Mission Training Plan (MTP) publications. The training is highly structured, yet allows units to meet their individual training needs by

[1]Throughout the remainder of the report, the authors use the term Janus to refer to the ARPA version of Janus.

offering a library composed of over 100 exercises. Furthermore, training can be tailored for either weekend drills or 2-week AT periods to accommodate RC and ARNG training.

The VTP battalion training in SIMNET consists of two exercises, one for each of the two missions. The exercises are conducted with the battalion staff operating in a simulated main command post (CP) and combat trains command post (CTCP), while the battalion commander, company commanders, platoon leaders, and vehicle crews operate in simulators. Each of the SIMNET exercises can be executed by a unit configured as a tank pure battalion or a tank-heavy task force. Exercises developed specifically for the battalion staff include the Janus exercises which are built around the same two NTC missions. The Janus staff exercises for tank-heavy task forces require only the battalion commander, S-3, main CP and CTCP personnel to participate; other roles (e.g., company commander, fire support) are designed to be performed by VTP O/Cs.

Exercises were also developed for armor, mechanized infantry, and scout platoons, as well as company teams and divisional cavalry troops. All of these exercise packages are designed for implementation on SIMNET at the Mounted Warfare Simulation Training Center, Fort Knox. The exercises are generally segmented into 1-hour periods of execution, preceded by short preview periods and followed by AARs. The segments, called tables, are designed to provide repetitive, but increasingly difficult practice on ARTEP-based tasks. A total of 48 platoon tables, 36 company team tables, and 15 cavalry troop tables are resident in the library.

Shortly after the creation of the VTP, the "Simulation-Based Mounted Brigade Training Program (SIMBART)" Project expanded the library through the addition of brigade staff MTC, area defense (AD), and deliberate attack (DATK) exercises to be conducted in Janus (Koger, Long, Sanders, Broadwater, Brewer, & Britt, 1996). The development of these exercises was completed during the time frame of the SIMUTA-B Project.

AARs

Exercise execution is reinforced by AARs that are conducted shortly after the end of each exercise. Several factors make it possible to shorten the AAR time cycle used at combat training center (CTC) sites. First, the simulation technologies allow the VTP O/Cs to see and hear critical events and actions that would not always be observable during a CTC or field training exercise (FTX). The VTP O/Cs, observing the exercise from individual workstations, are also in direct communication with each other, allowing them to discuss and plan AAR topics while the exercise is still ongoing. Second, the SIMNET and Janus simulation playback capabilities are available to all O/Cs immediately after an exercise or table. The VTP O/Cs, who keep notes regarding the times of significant events, can quickly structure a brief visual review of important aspects of the exercise. Third, the exercises are highly structured, in terms of events, which allows the AAR topics to be preplanned. The VTP O/Cs have only to prioritize the topics according to unit performance. As the O/Cs become experienced with the exercises, they can anticipate the kinds of problems units will encounter. Fourth, in SIMNET exercises, VTP O/Cs have the ability to review performance-based data generated by the Unit Performance Assessment System (UPAS) developed by ARI (Meliza, Bessemer, Burnside, & Shlechter, 1992).

THPs

Another component of the VTP is the THP. At every echelon, the THP focuses on the information most sought by the training units: "How well did we perform in terms of doctrinal tasks and standards?" The THPs provide participating units with observations and comments regarding their performance on the tasks and subtasks that were targeted by the exercises they completed. This is especially helpful to unit commanders who use the training to assess and update their mission essential task list.

The Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion Project

Capitalizing on the success of the SIMUTA Project, the U.S. Army initiated an effort to expand the VTP library to more completely meet the needs of training units. The initial purpose, contained in the SIMUTA-B statement of work (SOW) (U.S. ARI, 1994), of the SIMUTA-B Project was three-fold:

1. To increase the number of battalion missions available in the VTP's library through implementing the SST development methodology documented by C.H. Campbell et al. (1995). The mission to be added was the DATK. The DATK mission was selected by senior Army personnel, who had identified the need for training on this mission based on noted training deficiencies.

2. To upgrade the existing VTP battalion training support package (TSP) based on lessons learned during the SIMUTA and SIMUTA-B Projects.

3. To identify existing VTP company team and platoon exercises that could provide lower echelon training for the newly developed battalion mission. For segments of the battalion mission that were not available, developers were to identify the appropriate tasks and critical subtasks that could be used to develop new DATK company team and platoon exercises.

An additional requirement, imposed by the steering committee after the project's kickoff, was to enhance the focus on combat service support (CSS) tasks. This requirement was emplaced in response to unit requests for more practice opportunities on CSS tasks. The addition of the DATK mission increased the emphasis on CSS tasks.

Upon nearing completion of the original SIMUTA-B Project, the research and development effort was extended as the SOW (U.S. ARI, 1994) was revised (U.S. ARI, 1995). The extension stipulated the actual development of new platoon and company team DATK exercises that would be linked to the new SIMNET battalion exercise. These new exercises were to be developed based on the previously mentioned analyses of tasks and critical subtasks. In addition, developers were to develop a second battalion Janus DATK exercise that would include engineer play. This exercise was to provide staff training that would help units focus on using engineers in their operations. All exercises were to incorporate enhanced features of the Janus and SIMNET simulations.

Comprehensive List of SIMUTA-B Project Objectives

The project objectives were articulated in the original and revised SOWs (U.S. ARI, 1994; U.S. ARI, 1995). A concise portrayal of the SIMUTA-B Project objectives is presented below.

1. To develop and formatively evaluate two new DATK Janus staff exercises for tank-heavy task forces: one including engineers and one not including engineers.

2. To develop and formatively evaluate two new battalion DATK exercises in SIMNET: one for a pure armor battalion and one for a tank-heavy task force.

3. To identify, from the existing VTP library of MTC and DIS exercises, platoon and company team tables that could be used to represent segments of the battalion SIMNET DATK exercise. For segments not represented, to identify the appropriate platoon and company team tasks and critical subtasks.

4. To develop and formatively evaluate armor platoon, mechanized infantry platoon, and armor company team tables in SIMNET for the battalion task force DATK exercise without engineers; these tables were to represent segments of the SIMNET battalion DATK exercise not already supported by existing lower-echelon VTP tables.

5. To integrate the new and existing training[2] by upgrading existing VTP battalion and staff exercises and TSPs.

Organization of the Report

The remainder of this report documents the design and development of the DATK exercises, the upgrading of the associated TSPs, and the lessons learned during these processes. Specifically, the next section focuses on the exercise design process. Following the design discussion is a description of the formative evaluation objectives and methods. Because the results of the formative evaluation are closely tied to product development, these results are discussed in the fourth major section of this report, Training Development, as explanations for the improvements made to the training exercises and training support products. Finally, the last section of this report presents the lessons learned throughout the course of the project. The lessons are written for the benefit of future training development efforts.

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[2]Throughout this document, existing exercises and tables refer to those developed by the SIMUTA Team under the initial SIMUTA contract.

TRAINING DESIGN

Because of the extension of the SIMUTA-B Project, there were actually two design phases. The first, which occurred near the beginning of the project, was dedicated to designing battalion training. The second, occurring nearly 11 months into the project, focused on designing company team, platoon, and additional battalion training. This report discusses both design phases in tandem.

The process of designing training included the following activities: identifying training objectives, developing a scenario story line, and creating exercise outlines. The goals were to create exercises that emphasized maneuver execution in SIMNET, staff processes and maneuver execution in Janus, and combat support (CS) and CSS in both simulations.

The SIMUTA-B Team was required to link the DATK exercises with existing VTP exercises, and with divisional brigade exercises developed by the SIMBART (Koger et al., 1996) and the "Force XXI Training Program (FXXITP) Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation (COBRAS)" (Graves et al., 1996) projects. The exercises, as developed for the Janus and SIMNET simulations, were also to be mutually supporting (i.e., across both simulations, the exercises were designed to be as identical as the simulations would allow).

The training was to include tasks from the new ARTEP-MTP manuals as the manuals approached final draft status. Finally, the battalion exercises representing different missions were to flow from a continuous story line to provide opportunities for units to execute them in a tactically sequential fashion. The products of the design phase included outlines for all exercises. This section describes the design process, through the completion of the exercise outlines.

Unlike the SIMUTA Project, the SIMUTA-B Project was given fairly specific parameters for the DATK mission. This eliminated the need for the SIMUTA-B Team to make many initial decisions, such as those made early in the SIMUTA Project. The sponsor specified the story line, the unit type and echelon to be trained, the terrain, the simulations, and the execution time. Each of these specifications was derived from the scenario and exercises being developed concurrently under the umbrella of the SIMBART and FXXITP COBRAS programs. Activity 1.1 in the SST development methodology (C. H. Campbell et al., 1995) informs training developers of the importance of making and documenting initial decisions, such as those listed above.

Identifying Training Objectives

During the initial stages of the design phase, developers recommended tasks and critical subtasks to be trained. Task selection was guided by the mission, the target audience, the simulation system, and the SIMUTA-B Team's attempt to create an emphasis on: (a) maneuver execution in the SIMNET exercise; (b) staff process, staff and commander reactions, and maneuver in the Janus staff exercises; and (c) CS and CSS in all battalion exercises. The specific steps involved in the task selection process were the following:

1. Establish a domain of potential tasks.

2. Filter potential tasks against SIMNET and Janus capabilities.

3. Identify filtered tasks that are explicit or implied in the DATK scenario.

The above processes are representative of Activities 2.1, 2.2, and 2.3, respectively, in the SST development methodology (C. H. Campbell et al., 1995). The methodology suggests that when modifying an exercise by changing the mission, but not the type of unit trained, training developers should use the task domain in existing exercises from which the modifications will be made. Although the SIMUTA-B Team relied on the existing task domain to a certain extent, the continuing evolution of some task sources caused developers to examine other task sources as well. For example, the evolving doctrine for armor platoons resulted in a newly published FM and ARTEP-MTP, which changed the nature of many existing tasks. In addition, the DATK mission requires the execution of tasks (i.e., breaching tasks) which are not represented in the VTP's MTC and DIS missions.

Establishing Task Domain

The task domain for the SIMUTA-B Project comprised tasks for tank battalions, task forces, armor companies, company teams, and mechanized infantry, armor, and scout platoons. Two primary categories of sources existed: (a) standard training and doctrinal Army publications that included appropriate FMs and ARTEP-MTPs, and (b) supplemental sources composed of developmental analyses that attempt to define battalion activities as an integrated system.

ARTEPs and FMs

Applicable ARTEPs and FMs are listed in Appendix B. They describe missions and collective tasks specifying conditions and standards for their execution and evaluation. Although there are some differences between the FM and ARTEP organizational missions and tasks, together the FMs and ARTEPs constitute a standardized source for assembling tasks, by echelon and mission, into a consistent format.[3] Although the ARTEP-MTP and FM for armor platoons were in final draft status, the SIMUTA-B Team received concurrence from ARI to use tasks from these manuals. During the SIMUTA-B Project, the ARTEP 17-237-10-MTP for the Tank Platoon (Department of the Army [DA], 1995) was published.

Supplemental Sources

There are two efforts that define combat tasks and functions, staff coordination, and supporting activities. The supplemental task sources consulted during the SIMUTA-B Project included the Critical Combat Function (CCF) products (Mullin, 1996) and Battle Staff Integration and Organizational Competencies (Olmstead, 1992).

During the time frame of the SIMUTA-B Project, work on the CCF Project had been extended from what had been completed during the time frame of the SIMUTA Project. As a

[3]The various sources are inconsistent in how they portray relationships between tasks and missions.

result, the SIMUTA-B Team conducted another review of the CCFs to determine their utility and applicability to the SIMUTA-B objectives.

A comparison of CCFs and ARTEP-MTP tasks revealed many similarities. Both contain tasks and subtasks that describe battlefield performance, both encompass the entire range of tasks necessary for success on the battlefield, and both cover each battlefield operating system (BOS). The differences lie in organization and standards. The CCFs are organized along very specific functions across general mission areas, while the ARTEP-MTP tasks are organized along specific mission areas. In addition, many ARTEP tasks are defined by standards that facilitate measurement, or at least observation of unit performance. The CCFs contain outcomes that are focused at the macro level, and lists of tasks and subtasks that identify important processes and activities (but not necessarily performance standards) that occur in association with other CCF tasks.

After an in-depth review of the CCFs, the SIMUTA-B Team concluded that CCFs did not add any observable tasks or subtasks that had not already been obtained from the FMs or ARTEP-MTPs. The CCFs were valuable to the SIMUTA-B Project, however, as they provided an organizational structure which associates ARTEP tasks across combat functions. This provided a convenient double check to ensure all appropriate tasks were addressed, and that none were omitted.

Olmstead's Organizational Competencies (Olmstead, 1992) were found to offer a structure in which to frame battle staff behaviors and actions. The decision of whether or not to incorporate these competencies into the VTP battalion training was an important event in the training design process. Inclusion of these competencies would have influenced the format of AARs and the training objectives for each exercise. The SIMUTA-B Team chose not to include them for two reasons. First, although the competencies capture staff behaviors in a conceptual manner, the terminology employed is not easily translated into the language of the battle staff. Second, the more specific ARTEP-MTP tasks and subtasks cover the internal staff processes contained in Olmstead's work.

Filtering Tasks According to Simulation Fit

The second major step in identifying tasks was to determine which tasks could be trained in SIMNET, Janus, or both. To make this assessment, developers reviewed the decisions reached by the original SIMUTA Team, taking into account any simulation enhancements that may have impacted each simulation's capability to support the performance of previously classified tasks and critical subtasks.[4] Tasks were judged according to the degree that they could be performed in the current SIMNET and Janus environments through an application of the Burnside (1990) procedure.

[4]Burnside (1990) assessed which collective tasks could be trained on SIMNET for the armor platoon ARTEP 17-237-10-MTP (DA, 1988c; DA, 1995), the tank and mechanized infantry company team ARTEP 71-1-MTP (DA, 1988b), and the tank and mechanized infantry battalion task force ARTEP 71-2-MTP (DA, 1988a).

Recent experience during the SIMUTA effort has shown that a strict application of the Burnside (1990) procedure may yield too few tasks to adequately retain mission focus and flow within an exercise. For example, only 35% of the ARTEP 17-237-10-MTP (DA, 1988c) armor platoon tasks were recommended for training based on Burnside ratings of "highly" or "partially" supported. In light of this possibility, the SIMUTA-B Team accepted some tasks for training even though they were judged, by the Burnside procedure, as being inappropriate for the simulation. These tasks, while being overall inappropriate, contained subtasks that were judged to be appropriate and necessary to maintain mission flow. In essence, our orientation was more accommodative and less prohibitive regarding the inclusion of borderline tasks.

To replicate the Burnside (1990) method for the battalion staff tasks in which the filter was the extent to which they could be trained in Janus, the SIMUTA-B Team made use of the insights provided by the work of the original SIMUTA Team and additional existing documentation on Janus. This documentation provided preliminary direction for including or eliminating tasks based on emerging Janus technological characteristics and capabilities. The SIMUTA-B Team, during exercise pilots and trials, conducted the final tests of the extent to which tasks could be executed in Janus.

Selecting Tasks for a DATK Mission

Task appropriateness was also characterized by the question, "Is the task likely to occur during a DATK mission?" Hence, military subject matter expert (SME) personnel created a revised task list by examining the recommended tasks, and selecting those appropriate for the DATK mission. Critical subtasks were selected based on the criterion of criticality to mission performance.

The selection process began with an analysis of the tasks that survived the simulation filtering process to identify those that were applicable to a DATK mission. At the completion of the task selection process described above, training developers had identified a list of battalion, company team, and platoon tasks that could be executed on the relevant simulations and within the context of any DATK mission. Further refinement of the task lists was accomplished after the creation of the SIMUTA-B DATK mission. Developers matched the tasks and subtasks to events to identify only those that occur in the SIMUTA-B DATK mission. Appendix C presents the final task lists for the DATK training by echelon and unit type.

Designing the Scenario

After identifying the training objectives, the SIMUTA-B Team began designing the scenario. Developers used the battalion story line provided to delineate further the details of the battalion scenario. The scenario: (a) accounted for the training objectives, (b) incorporated CS and CSS operations, and (c) was linked to the brigade exercises being developed in the SIMBART and FXXITP COBRAS projects. Fleshing out the scenario, and outlining the exercises represented Activities 3.1, 3.2, 3.3, and 3.4 from the SST development methodology (C. H. Campbell et al., 1995).

Developing the Battalion Story Line

The task of designing the story line represented a mutually supporting interaction of training design with OPORD development. That is, as developers developed the scenario, they simultaneously developed the battalion OPORDs.

To develop the story line, the SIMUTA-B Team prepared a rough draft of the mission that provided an initial idea of what would occur during execution. This included specifying plans for vehicle locations, major events, players, and friendly graphics. In creating the initial story line, developers also made estimations of where tasks would be performed during the course of the mission. Developers attempted to ensure that tasks identified as being applicable for a DATK mission could be executed in the story line. The mission sequencing was extracted from FM 71-2 (DA, 1988d).

It was at this time that developers began to construct the Exercise Training Event Matrix. This matrix allowed developers to designate the activities that would occur for each staff section and element of the battalion.

Each of the steps listed above are represented in Activity 3.1 of the SST development methodology. Hence, the SIMUTA-B Project developed the DATK story line in a method that was consistent with the SST development methodology (C. H. Campbell et al., 1995), with one exception. The methodology recommends adjusting the mission-appropriate task list based on the task list pertaining to the specific mission scenario. It is impossible to know, however, whether future changes in the exercise may require developers to revisit the original mission- appropriate task list. For this reason, we suggest that training developers should not replace the mission-appropriate task list with the modified list, but keep both lists readily available. Keeping both task lists is consistent with a thorough documentation strategy necessary for a systematic development process. Together, the lists represent tasks that can be trained in a DATK mission, and tasks that can be trained in the specific mission.

Throughout the process of developing the story line and OPORDs, developers conducted map exercises to ensure the mission supported the selected tasks, to verify that the mission was tactically adequate, and to ensure the terrain was appropriate.

Incorporating CSS Operations

Early in the project, the steering committee directed that the SIMUTA-B battalion exercises emphasize the CSS operations that could be played in the CTCP. In response, SIMUTA-B developers designed the exercises to include as many CSS doctrinal tasks as would be supported by the simulations. Developers also emphasized the importance of conducting CSS operations in the TSP.

During the course of the pilots and trials, the CSS operations remained generally untested; that is, the exercises were never run through the reorganization phase. It is important to note that no execution of the battalion DATK SIMNET or Janus exercises exceeded 3 hours, which was the time specification set forth in the SOW. Therefore, the conduct of reorganization operations

should have been an economical method of enhancing the training's benefit. In fact, the training units participating in the initial development of the VTP said they needed to be trained in CSS operations, and that focusing on such would have increased the value of the training (Hoffman et al., 1995). This sentiment was echoed during SIMUTA-B exercise tryouts. In the final section of this report, the authors expand on the implications of not prompting CSS play, and discuss a solution.

Creating Mutually Supporting Exercises

In the SIMUTA-B Project, developers were to design a DATK mission story line that would be contiguous with the existing VTP MTC and DIS story line, and set within the context of the SIMBART and FXXITP COBRAS DATK story line. In addition, developers were to design the DATK Janus and SIMNET battalion exercises to be mutually supporting in terms of tasks trained, which would enhance training transfer between exercises.

Creating a Continuous Story Line

As a part of the design process, developers developed a continuous story line between the DATK mission and the battalion MTC and DIS missions. As a result, a training unit can execute the missions one after the other without experiencing significant tactical disconnects.

Creating Consistency Between Training Programs

Although not a requirement of the SOW, the SIMUTA-B Team was directed by ARI to create general consistency in terms of the scenario between the VTP battalion exercises and the brigade exercises developed by the SIMBART and FXXITP COBRAS projects. This involved not only the DATK exercise, but also caused SIMUTA-B developers to rework the existing VTP MTC and DIS battalion exercises to make them congruent with the FXXITP COBRAS and SIMBART MTC and AD missions, respectively.

The justification originated from two sources. The first was Brown's (1991) concept of immersion. Brown believed that a unifying mission would help soldiers become psychologically identified with the mission and thus heighten their motivation to perform. The second source was the Army itself. The Army has intentions to create a simulation-based training regimen that is consistent in terms of mission story line and tactics between training programs.

The SIMUTA-B Team worked closely with SIMBART and FXXITP COBRAS training developers to ensure the VTP MTC, DIS, and DATK story lines and exercises were consistent with those of SIMBART and FXXITP COBRAS. The resulting SIMUTA-B exercises, with some adjustment, can be conducted in conjunction with the SIMBART and FXXITP COBRAS exercises. The implications of this requirement for the SIMUTA-B Project are discussed in the Lessons Learned section.

Enhancing Training Transfer Between Simulations

The VTP Janus and SIMNET MTC and DIS exercises are mutually supporting between simulations; if executed first, a Janus staff exercise can prepare the staff for a full battalion SIMNET execution. The SIMUTA-B Team applied this same concept when designing the battalion DATK exercises. The Janus DATK exercise had to incorporate tasks that would facilitate training in the SIMNET DATK exercise. Janus staff exercises were designed to focus almost exclusively on staff tasks, while the SIMNET exercise was designed to incorporate maneuver or mission execution tasks as well as staff tasks.

In this endeavor, SIMUTA-B developers deviated slightly from the SST development methodology (C. H. Campbell et al., 1995). In the methodology, Activity 3.2 assumes that training developers are responsible for developing orders for the two echelons above the echelon for which training is being designed. However, because the brigade and division orders were developed by the SIMBART and FXXITP COBRAS projects, the SIMUTA-B Team had only to focus on integrating their OPORD with the higher level OPORDs.

Designing the Exercise Contexts and Specifications

Following the initial design phases of elaborating a battalion story line from the divisional brigade missions, the SIMUTA-B Team focused on refining the context of the DATK mission in which training units were to operate, and defining in detail many of the specifics of the scenario. The context information included the friendly and enemy situations, the preceding events, the organizations of all units, and a brief statement of exercise intent in terms of what the unit was to do. To further define the context, developers provided a description of the start points and planned end points of the exercise. These points were identified as events and as geographical locations.

The exercise specifications included the identities of all the units, how each vehicle or entity would be represented (i.e., modular semi-automated forces [ModSAF], simulator vehicles), and settings for the parameters (e.g., speed, hit probability) associated with employing those entities in the appropriate simulation. The above activities represent Activity 3.3 in the SST development methodology (C. H. Campbell et al., 1995).

Segmenting the Scenario

The requirement to segment the DATK scenario existed for two reasons. The first reason originated from a lesson learned during the SIMUTA Project. The SIMUTA Team designed the battalion exercises to last approximately 3 hours. However, if units were to perform inappropriate actions, a 3-hour delay in providing feedback would be too long to facilitate performance improvement. Therefore, the battalion exercises incorporated opportunities for interim AARs within the 3-hour execution time. These interim AARs were to follow each segment of an exercise. Interim AARs, however, were optional. If a unit was performing within certain guidelines, they could continue to the next segment of the exercise without an AAR.

Second, the segments became the framework by which developers identified table breaks for company and platoon exercises. The break points were used to identify separate exercises, but also to create exercises in which units would not begin in contact with enemy forces. These breaks, then, had to occur at logical points where natural breaks in contact were present.

To segment the exercises, the SIMUTA-B Team identified the roles of all subordinate echelons at each point in the mission, and the mission, enemy, troops, terrain, and time (METT-T) factors, by echelon, at those points. Events were then grouped into segments that provided the most logical, realistic, and productive framework for eliciting performance objectives and tasks.

Segmenting the exercises proved complicated. The tasks in the operation were initially grouped by the phases of the battle (movement, breach, assault, and consolidate/reorganize) as specified in FM 71-2 (DA, 1988d). These phases, however, did not allow for appropriate break points for purposes of interim AARs. The SIMUTA-B developers reviewed the tasks and sequencing to determine where the battle could be most easily paused, and found it necessary to divide the scenario into three segments: movement, breach/assault/consolidation, and reorganization. The breaks in action between each of these segments generally would allow the unit to interrupt execution when not in contact with the enemy or involved in some continuous action or task. Segmenting also allowed for restarting an exercise at a convenient point, in the case of a system failure or catastrophic unit decision.

Completing Exercise Outlines

Although development of the exercise outlines was initiated early in the design phase, their completion represented the last major design phase activity. The outlines provided: (a) a framework in which to incorporate critical subtasks into the exercises, (b) a means to ensure that the new exercises were developed to previously established levels of detail, and (c) a standardized system to record specifications for exercises. The format of the outlines was similar to that applied during the SIMUTA Project. It provided a straightforward, readily comprehensible method of portraying the key specifications and occurrences of the exercises. Each outline included the following elements:

- A mission statement;
- A task organization;
- Friendly and enemy situations;
- A higher unit mission;
- Unit locations;
- Preceding events;
- Technical specifications and parameters;
- Ending locations;
- A story line composed of events, cues, and unit actions; and
- Lists of critical subtasks.

In completing the outlines, military SMEs had provided a tool by which the exercises could be input easily into the simulations, and further revised. In essence, the outlines laid out the

blueprints for developing the exercises. Creating exercise outlines represented Activity 3.4 in the SST development methodology (C. H. Campbell et al., 1995).

FORMATIVE EVALUATION STRATEGY AND DESIGN

As was the case with the SIMUTA Project, the SIMUTA-B SOWs (U.S. ARI, 1994; U.S. ARI, 1995) stated that developers were to conduct a formative evaluation during the initial implementations of the training exercises. The formative evaluation was to include efforts to both monitor execution and provide assistance to O/Cs and training units during training program implementation. The goals of the formative evaluation were to ensure overall quality, high training efficacy, and consistency with project objectives. More specifically, the formative evaluation was to ensure the incorporation of Brown's (1991) concepts of compression, training distribution, incorporation of simulation technologies, and focusing on doctrinally-based tasks that are critical for mission execution.

In the SIMUTA Project, formative evaluation played a vital role in the development of complete and valuable training exercises and support packages. Because of this success, the SIMUTA-B Team chose to adopt the SIMUTA Project's formative evaluation model.

In essence, the formative evaluation efforts were designed to support the development process. The reader, therefore, should find it beneficial to understand the purposes and methods of the formative evaluation prior to examining the effects it had on the development process and the products developed. Hence, this section focuses on the design of the formative evaluation and the specific formative evaluation methodology.

Evaluation Design

The formative evaluation was achieved primarily through exercise tryouts. The tryouts had three purposes. First, they were a double check to show that the exercises interfaced properly with the simulation technologies. Second, they provided an opportunity to check the adequacy of the instructions to VTP O/Cs. Third, they allowed the training design to be evaluated in terms of its utility for unit personnel. This third purpose embodied three separate issues: (a) whether the instructions and procedures were clear to unit personnel, (b) whether the level of difficulty of the exercises was appropriate for the skills and abilities of unit personnel, and (c) whether units improved their performance as a result of VTP participation.

To facilitate a thorough and exacting evaluation of relevant issues, developers adopted a tryout level concept similar to that used in the SIMBART Project (Koger et al., 1996). Table 1 provides further explanation of the level concept as applied during the SIMUTA-B Project. From this point forward, exercise tryouts will generally be referred to as "pilots" or "trials." The distinction in terminology is based on who participated in the exercises. Pilots were tryouts conducted before the exercises were ready for training unit participation and were executed by

Table 1

SIMUTA-B Tryout Level Concept

Level	Purposes/issues evaluated
I	Pilot exercises conducted to test the feasibility of the exercise scenario in the simulations, to derive required technical support data, and to evaluate components of the tactical plan.
II	Pilot exercises conducted to stress the simulation systems in supporting exercise requirements.
III	Trial exercises conducted to evaluate the training management structure, to verify the tactical plan with external players, and to test the performance observation and feedback system.
IV	Trial exercises conducted to verify the exercise and training design in its entirety, and to stress the simulation systems.

SIMUTA-B and SIMBART developers. Trials were tryouts in which units participated as trainees. Generally, pilots were Level I and II tryouts, and trials were Level III and IV tryouts.

Although developers had devised the above strategy to test the exercises, test unit resource limitations necessitated deviations from the strategy in several cases[5]. It is important to note that even though the evaluation strategy was not fully executed for most exercises, the feedback received from trial participants indicated that the exercises met the overall quality and training efficacy standards set forth in the spirit of the SOW (U.S. ARI, 1994). This was due in part to additional testing conducted by the SIMUTA-B military SMEs. The additional test exercises focused primarily on the tactics employed and the ability of the exercises to cue relevant tasks.

The Effects of the Simulations on the Formative Evaluation

The success of the SIMUTA-B Project was dependent on creating training that would take advantage of the simulation capabilities to increase training efficiency and effectiveness. Therefore, project management ensured the team included members who had technical expertise with SIMNET and Janus, as well as other associated technologies, including ModSAF and UPAS. The contributions of these team members helped to ensure that both the development and the formative evaluation of the training would be successful. They were able to assist in developing exercises that take advantage of the simulations' capabilities to provide training on as many tasks as possible. During the formative evaluation of the exercises, they helped by ensuring that the

[5]Only the DATK armor platoon, mechanized platoon, company, and battalion/task force exercises were tried out during the SIMUTA-B Project.

simulations would operate as expected during tryouts. This allowed training units to execute exercises according to the evaluation design.

Trials

The SIMUTA-B exercise trials employed three methods of evaluation: (a) focused and structured observations by developers; (b) feedback from O/Cs; and (c) feedback, via questionnaires and interviews, from participating units. The evaluation methods for each trial were tailored to that specific execution, its purposes, and concerns.

Observation of Trials

Evaluators of the trials consisted primarily of members of the SIMUTA-B Team, with members of the SIMBART Team filling in as necessary. Before each trial, the evaluators met to assemble a list of issues that needed to be observed and evaluated. During these meetings, the objectives of the trials were further delineated and emphasized to the evaluators. After the meetings, forms were created that presented focus areas/objectives and questions to guide data collection efforts.

Each evaluator was particularly knowledgeable about either the tactical nature of the exercise and the scenario-specific events that would occur during execution, or the TSPs, or both. Because most evaluators had participated in the creation of the VTP, they were also familiar with the more global training context associated with the VTP. The Lessons Learned section of this report discusses the value of employing developers with program-specific experience.

To a great extent, evaluators were actually the developers of the training. For this reason, they were extremely familiar with the training being evaluated. On the positive side, this familiarity allowed observers to watch what was being done and to compare it with what had been planned. On the negative side, the observers were not always unbiased and impartial in their evaluations of "their" product. The authors estimate that this unavoidable bias effect did not cause any major flaws to go uncorrected. However, decisions regarding more subtle or debatable issues may have been biased toward the developers' original design specifications.

During the SIMUTA Project, evaluators focused heavily on the O/C Team's implementation of the training. By the time of the SIMUTA-B trials, however, the O/C Team had gained considerable and valuable experience in executing VTP exercises. The SIMUTA-B Team restricted their monitoring of the O/C Team's implementation to aspects of the training that had changed as a result of the SIMUTA-B Project. For instance, evaluators monitored battalion AARs not to evaluate teaching techniques, but to evaluate the utility and usability of the new observation forms and system created by the SIMUTA-B Team.

Questionnaires

Immediately after training units completed the exercise trials, evaluators distributed questionnaires to designated members of the participating units. These questionnaires contained core questions, applicable to both SIMNET and Janus trials, and others which related specifically

to the simulation used, the echelon trained, and the objectives of the trial. The questionnaires addressed the components of the program from beginning to end and were used to spot weaknesses in the procedures. Questionnaire results were used in preparation for future trials and product deliveries.

Interviews

The SIMUTA-B Team conducted group interviews with members of the training units after the final AARs were completed. The purpose of the interviews was to collect information that supplemented the data collected on questionnaires. The open-ended structure of the interviews created discussion and stimulated unit members to suggest improvements to the program. Interviews typically lasted from 45 minutes to 1 hour.

Tryout Schedule

Pilots and trials were conducted for the lion's share of the DATK exercises. Figure 1 illustrates, for each type of exercise, the time frames of the level III and IV tryouts relative to the entire development time frames. Level I and II pilots of each exercise were conducted continually throughout the development process; thus, the presentation of a detailed schedule of their occurrence would be overly cumbersome.

The exercise tryouts represented the decisive events of the developmental process and the primary vehicle for refining the training. In describing the development efforts, the ensuing discussion highlights the major findings of the tryouts, substantiating the utility of the SIMUTA-B formative evaluation.

TRAINING DEVELOPMENT

The focus of this section lies not in providing a detailed description of the entire development process, but in presenting an overview of the accomplishments and the major problems encountered during the project. The activities undertaken included developing exercises and TSPs, and upgrading the original SIMUTA battalion TSPs. This section develops the background necessary to prepare the reader for the lessons learned, which represent the main focus of the report's content.

Developing the Exercises

Because the development process and the formative evaluation were intertwined, the discussion of exercise development is based on the results of the formative evaluation. These results reflect issues encountered, obstacles overcome, and key accomplishments. For a more complete discussion of the development methodology, the reader should reference C.H. Campbell et al. (1995) and Hoffman et al. (1995).

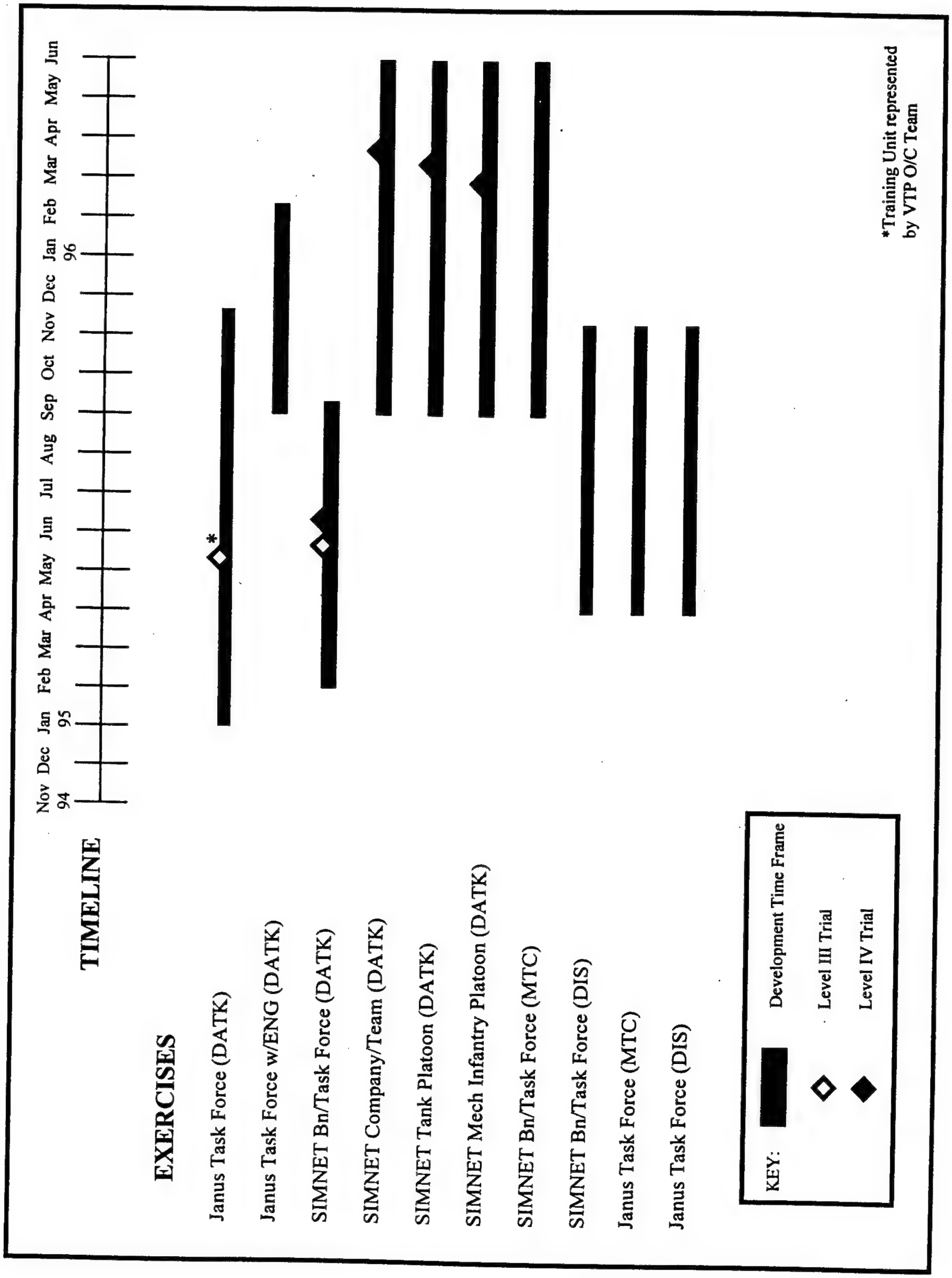

Figure 1. Exercise trial dates in relation to exercise development time frames.

As stated earlier, the SIMUTA-B Project created DATK exercises at three echelons: battalion, company team, and platoon. In order to avoid confusing the reader with detail specific to the development of each exercise and echelon, the authors have consolidated the discussion into two sections defined primarily by echelon. Battalion exercise development is discussed first, followed by discussion of the company team and platoon exercise development.

Battalion Exercise Development

The SIMUTA-B Team developed three DATK battalion exercises, one in SIMNET and two in Janus. The formative evaluation highlighted issues that addressed a number of conceptual, yet practical, aspects, including the capability of the simulations to support the exercises, and the utility of the training and its design characteristics.

Exercise Supportability in Simulation

Two simulation systems were utilized for the battalion-level exercises: SIMNET and Janus. Regarding the capability of the simulation systems to support exercise development and execution, the following issues arose and should be noted by others in the field.

Janus and SIMNET fighting parameters. The characteristics of Janus are significantly over weighted on the side of the defender, be it opposing forces (OPFOR) or friendly forces (BLUEFOR). For example, the ability to become visible only momentarily for engagement purposes, and then become undetectable again, can be used unrealistically. The OPFOR controllers can attain an unrealistic advantage, making it impossible to judge accurately whether or not the exercises would allow training units to conduct missions successfully and fulfill stipulated training objectives. The relationship between a controlled OPFOR and the fulfillment of training objectives is discussed in more detail in the Lessons Learned section.

A similar problem exists within SIMNET. That is, certain vehicles demonstrate unusually high levels of armor protection (e.g., BMPs). The BLUEFOR units are thus required to use an unrealistically large amount of firepower against these vehicles in order to assure their destruction. The SIMUTA-B Team suggests that both of these simulation characteristics be reviewed by simulation system designers.

ModSAF development idiosyncracies. As a general note, the version of ModSAF used for this effort (ModSAF 1.5.1) operated with a number of idiosyncracies. Furthermore, it did not always operate in a manner consistent with that described in the user's manual. Both these factors caused delays in the SIMUTA-B exercise development process. Each time an idiosyncracy surfaced, developers had to work around it. In the Lesson Learned section, the authors discuss the relationship between the development of simulation systems and the goals of the training programs that employ the systems.

Janus AAR capabilities. The automated AAR capabilities of Janus provide information that relates primarily to battle outcome; they are outcome-, not task-oriented. This outcome-based orientation is not consistent with the objectives of SST. A ratio of red and blue losses, for example, is determined as much by luck, good "gamesmanship" on the part of simulation

operators, and the built-in parameters of Janus, as it is by staff task performance levels. If O/Cs use the automated AAR capabilities, they must not only present the automated data, they must also make the important connection to task performance (staff activities) that lead to the outcomes.

Unit staffing in a Janus staff exercise. The designed staffing for the Janus staff exercises requires VTP O/C Team members to perform the fire support team (FIST) and first sergeant (1SG) tasks, as well as operate all maneuver workstations. Occasionally, however, training units provide personnel to fill these roles. The authors believe that this option does not facilitate the training of battlestaff personnel. This is especially true when training units use their own company commanders (with radio telephone operators, 1SGs, Executive Officers, and others) at the maneuver workstations. The difficulty in properly using the Janus system, coupled with their unfamiliarity with the exercises, creates an exercise heavy on tactical misadventures and light on staff training. Their performance may inadvertently lessen the training impact for the staff.

Training Design

Much of the formative evaluation focused on the fit between the design of the battalion training and the needs of the training audience. When units were queried regarding their thoughts on the design of the training, most of their comments focused on how the tactics and task organization could be improved.

Units made several suggestions relating to mortar placement, phase line locations, ambulance exchange point (AXP) placement, and the inclusion of tasks relating to preparing against a counterattack. Units also asked that the developers include company team formations in the OPORDs, stronger OPFOR units to inflict punishment on slow breaching units, and a schedule of fires like what they would use in the field. They also suggested that the AXP be moved further to the rear, that Alpha company be ready to defend against a counterattack, and that mortars be repositioned. Each of the above comments was interpreted as being reasonable and valuable to improving the training. The units made several additional requests dealing with the amount of CSS play cued by the exercise. The units wanted more CSS play, such as reorganizing personnel assets. They reiterated the importance of practicing CSS play. In the Lessons Learned section, the authors deal with the issue of incorporating CSS play in the VTP exercises.

Other Comments Made by Trial Units

Units who tried out the battalion exercises provided many valuable comments that influenced the development of the training as discussed above. In addition, they commented about the perceived effectiveness of the training and how it helped them improve their performance. Specifically, the units said that the CS/CSS Annex of the OPORDs was very useful. They also praised the AARs, saying that they were positive and provided accurate feedback. They said the O/Cs were good coaches and were able to draw information from the audience. Regarding the training's value, one battalion commander reported that the training "...saved our state $780,000 in parts and fuel costs for this AT." Members of his staff said "...the training was

the best multiechelon training we have ever received." The training benefits cited included that the training helped the unit improve their internal staff operations.

Company Team and Platoon Exercise Development

In addition to battalion exercises, the SIMUTA-B Team developed exercises for armor and mechanized infantry platoons, armor companies, and company teams. All were developed for implementation in SIMNET. Notably, the issues that arose during the development of the lower-echelon exercises were in the same vein as those encountered during the development of the battalion exercises.

Exercise Supportability in Simulation

Regarding the capability of the simulations to support exercise development and execution, issues in the following areas arose and should be noted by others in the field.

The behavior of ModSAF vehicles. The BLUEFOR ModSAF elements present in the company team and platoon exercises often acted erratically when coming into contact with enemy vehicles defending the breach site. As a result, developers were forced to turn off all BLUEFOR ModSAF element capabilities to conduct actions on contact. This solution, although cumbersome, did create a more stable and realistic environment for the training participants.

Splitting ModSAF files. To create the ModSAF files for the three company team exercises, developers split a single previously developed file into three separate files. They then deleted the routes, graphics, units, and other entities that were no longer needed. Upon completion, developers noticed that, what they called ghost instructions, remained in the data base despite their apparent removal. These ghost instructions were estimated to have caused data base failures ranging from erratic and unpredictable actions by ModSAF units, to station core dumps. In the end, developers had to rebuild each exercise file from scratch.

O/C Team resource requirements. The platoon exercises were initially designed to use one workstation; this was the model used in the original SIMUTA platoon exercises. During the development process, developers found it necessary to add more workstations to account for the full range of friendly forces needed to represent the battalion task force. The VTP O/C Team, concerned about personnel and equipment availability, requested that this requirement be relooked. They did not want to dedicate more than one workstation for any platoon exercise. Because the exercises included over 150 ModSAF entities and each workstation had an upper capacity of only 60 entities, the exercises and ModSAF files were redesigned.

Two options were tested to meet the needs of the O/C Team. The first option required scenario developers to load each of the four separate ModSAF scenario files onto one workstation. This approach proved to be unnecessarily complicated. In addition, it caused frequent workstation shutdowns. The second option was to reduce the entity count significantly. This option was initially thought to be less desirable because it detracted from training realism, but was selected by default. The realism was sustained to some extent in that the entities that were eliminated most often represented vehicles out of the training unit's line-of-sight. The SIMUTA-

B Team's final recommendation was that the O/C Team could use one workstation, but that they should also employ a second workstation as a backup to increase the available memory capacity and decrease the negative consequences of workstation failures.

Splitting out ModSAF entities. To provide maximum realism for the training audience, the SIMUTA-B Team split out the BLUEFOR ModSAF units to a level that would facilitate the unit's perception that the vehicles were operating independently, as they would if they were manned. To do this, they built separate files for each workstation used during an exercise. All but the primary workstation were used to portray only ModSAF units. The problem inherent in this design was that O/C personnel had to pay constant attention to a large number of independent entities which increased the difficulty of obtaining realistic movement formations. In response, the SIMUTA-B Team rebuilt the scenarios, combining some independent entities into groups. Specifically, the FIST, 1SG, ambulance, and recovery vehicle represented one entity group, while the other three entity groups represented company teams. This combination provided a good combination of O/C control and simulation realism.

ModSAF workstation memory. During the platoon exercises, the O/Cs experienced frequent problems with ModSAF memory overload. The fix devised by the SIMUTA-B Team required the addition of a simple step to the workstation operator's normal system operating procedure. Training guides were modified to instruct the O/Cs to log off all workstations between exercises. This step clears the memory and allows the workstation to start off with a clean slate at the beginning of each exercise.

Training Design

As was true during battalion exercise development, attempts to determine the utility for the training audience often elicited comments relating to doctrinal soundness and tactical realism. As a result, the SIMUTA-B Team made a number of modifications to the company team and platoon exercises. Among others, these modifications included increasing enemy engagements to sustain unit interest and enthusiasm, and placing navigational aids (e.g., target reference points) on the battlefield to compensate for the navigational problems commonly experienced in SIMNET.

Other Comments Made by Trial Units

During interviews and via questionnaires, the test units provided valuable information regarding the training's effectiveness. Overall, the units said that they got a lot out of the training. In addition they reported that the tables were appropriately difficult, and not too easy. They said that the training helped them improve individual skills, unit formations, and actions on contact. They said they liked the matrix format in which the platoon OPORDs were presented, but that the OPORDs should have included grid coordinates for the scout locations. They commented that this would have facilitated their preparation efforts, allowing them to make better use of their time. Finally, one unit that executed platoon exercises reported that the O/C-produced company message traffic should have been more frequent and intense. The Lessons Learned section provides the SIMUTA-B Team's response to this final comment.

Developing the Training Support Packages

For the company team and platoon exercises, the team created a new TSP for the DATK exercises. For the battalion exercises, however, not only did the team create a TSP for the DATK exercises, but they also retrofit the existing VTP battalion TSPs to the new format represented in the DATK TSP. In the SST development methodology (C. H. Campbell et al., 1995), Activities 4.1 and 4.2 represent the process of developing TSPs. The approach taken by the SIMUTA-B Team was to form the new TSPs out of the existing TSPs. Therefore, the team did not actually develop an entirely new TSP. This section begins by describing the results of developing and retrofitting the battalion TSPs, and concludes by discussing the lower-echelon TSPs.

Upgrading the Battalion TSPs

The SIMUTA-B Project represented an expansion effort that, as one objective, would increase the number of battalion exercises in the VTP's exercise library. Not coincidentally, there was also a requirement to incorporate new ideas and lessons learned during the development of these new exercises into the TSP materials of the existing exercises. In other words, the SIMUTA-B Team was to develop new exercises with an improved TSP structure, and then update the old TSP products to the new standard. This section describes the modifications made to the battalion TSP by the SIMUTA-B Team. The modifications included manipulating the TSP's organizational structure, transitioning to a structured writing style of information presentation, and incorporating a limited amount of new training guidance.

Volume Organization

One of the first endeavors undertaken during the SIMUTA-B Project was to reorganize the structure of the VTP's battalion TSP. The principal goal was to create a TSP structure that would facilitate the addition of new missions. In actuality, this process evolved into a joint effort between the SIMUTA-B and SIMBART projects. The input from the SIMBART Team was essential because they were developing a brigade TSP for the VTP, and consistency between TSPs was judged as being tantamount to maintaining an easy-to-use library of products. The reasoning behind the reorganization of the TSP was multifaceted and will be discussed, along with the benefits achieved, in the Lessons Learned section of this report.

The SIMUTA-B Project devised a structure that provided two battalion TSPs: one for Janus staff exercises and one for SIMNET exercises. The only differences in the volumes related to the content, which varied due to differences in simulation architecture and function. The primary differences between the original and refined TSP organizations are best explained by presenting the new TSP structure and noting the original volumes and components that were incorporated in each of the new volumes. Table 2 presents this information.

Table 2

The Revised Volume Structure for the SIMNET Battalion TSP

Volume Number and Name	Contents
Volume I, SIMNET Battalion Task Force Training Guide	The content of this volume is similar to that of the original Training Guide. The new guide differs in that it is more streamlined, providing only an overview of the training process. The guide allows VTP O/Cs who are filling higher-level roles to learn about the duties of each O/C role without reading an entire mission volume, described below.
Volume II, SIMNET Battalion Task Force Exercise Unit Pre-Exercise Materials	This volume contains all the information needed by a unit to prepare for any exercise, minus OPORDs and overlays. It incorporates preparation guidelines and information from the original Training Guide. It eliminates the need for VTP O/Cs to extract parts of the original Training Guide for presentation to training units.
Volume III, SIMNET Battalion Task Force Exercise Package for the MTC	This mission volume contains all the information needed by the VTP O/C Team to conduct the battalion-level MTC mission in SIMNET. It consolidates the appropriate information from the original VTP O/C workbooks and the Training Guide. Its advantages include helping O/Cs save time in that they do not have to deal with information about the DIS and DATK exercises when conducting the MTC exercise. Each O/C extracts from the volume the materials specific to his/her role in the exercise.
Volume IV, SIMNET Battalion Task Force Exercise Package for the DIS	This mission volume is identical in composition to Volume III in structure, but its contents relate to the battalion DIS exercise.
Volume V, SIMNET Battalion Task Force Exercise Package for the DATK	This mission volume is identical to Volumes III and IV except that it applies only to the battalion DATK exercise.

In addition to the volumes identified in Table 2, the SIMUTA-B Team also reviewed the Orientation Guide that was resident in the original VTP TSP. The Orientation Guide was originally intended to be a marketing tool that would provide information to help units plan and schedule VTP training. In reality, however, it contained information that units needed to prepare for the training as well. This made for an awkward training preparation process. A final goal of

the SIMUTA-B Project was to revise the Orientation Guide so that it would more succinctly fulfill its original purpose.

The changes made to the Orientation Guide were numerous. First, information needed for exercise preparation was extracted and included in Volume II as described above. At this point, the book already resembled an entity more in line with the desired end-state. Second, the SIMUTA-B Team incorporated information regarding the new DATK exercises, and explaining the revised TSPs and how to use them. Finally, in collaboration with ARI-AFRU, the team included a discussion of SST that explains its benefits and the implications relating to unit preparation and conduct of the VTP exercises. This information addressed a significant problem observed throughout the duration of the VTP's existence. The problem was that units tended to resist the SST concept, which prohibited them from receiving the full benefit of the training. In the Lessons Learned section, the authors discuss the reasons for incorporating an explanation of SST in the TSP.

Presenting Training Guidance Through a Structured Writing Technique

The second major modification to the TSP entailed transitioning to a structured writing style of presenting training guidance. This venture was also conducted through collaboration between the SIMUTA-B and SIMBART projects.

Although not included as a requirement in the SOW (U.S. ARI, 1994), the transition to structured writing became one of the most visible, as well as key, aspects of the project. The concept of incorporating structured writing in the TSPs was initiated in response to two cues. The first was a recommendation in the U.S. Army Training and Doctrine Command (TRADOC) Regulation 25-34 (DA, 1993b) to use structured writing for preparing TRADOC administrative publications. The second was a concern on the part of the SIMUTA-B Team that the original TSPs were overly complex and did not present implementation instructions clearly or concisely.

Briefly, structured writing involves the organization of information in an easy-to-use format. Because of the presentation format, but also because of the requirement to organize information, the SIMUTA-B Team acquired a structured writing software tool entitled Information Mapping®. Information Mapping® is the brain child of Robert E. Horn (1973). The software is compatible with the major word processing programs and is used as a supplement to such. It contains instructions that help writers organize and structure information for presentation purposes. The name, Information Mapping®, is most descriptive of the process it facilitates; that is, it helps writers place, or map, information into related categories. For details regarding the benefits achieved through the use of structured writing, see the Lessons Learned section.

Designing New TSPs for Lower Echelon Training

The SIMUTA-B Project was to develop company team and platoon exercises for the DATK mission. Inherent in this development was the requirement to produce a corresponding TSP for these exercises. Because this requirement was executed after the battalion exercises and TSPs were created, the ideas used for the battalion work were incorporated into the lower echelon DATK TSP. There was no requirement to retrofit the lower echelon MTC and DIS TSPs.

The primary modifications made to the original TSP design related to a reorganization of the TSP components and the incorporation of the structured writing technique discussed above. In the reorganization, the SIMUTA-B Team consolidated all the DATK materials for trainers and trainees into one volume. As was true at the battalion level, the goal was to devise an organizational design that would facilitate the addition of future volumes for new missions.

Reactions of the VTP O/C Team

The reaction of the VTP O/C Team is the best indicator of the benefits achieved through incorporating the new structure and writing style into the VTP TSPs. This team is the primary user of the TSPs. While not initially receptive, several O/Cs later commented that they were extremely pleased with the new ideas. The Lessons Learned section dealing with the benefits of structured writing provides more detail about their response.

Modifying Training Design

Although the SIMUTA-B Team was tasked to retrofit the battalion TSPs, the original TSPs did not warrant a complete overhaul, but conversely, were judged to be exemplary products. For that reason, there were a limited number of modifications made to the training. Those that were made, however, included reworking the task list structure, redesigning the observation forms used by the VTP O/C Team to record unit performance, modifying the AAR preparation and conduct process, and redesigning the THP composition process. The only significant change made to the training design of the company team and platoon exercises was changing the presentation format of the OPORDs.

Modifications to the AAR Preparation and Conduct Procedures

After observing that the VTP O/C Team was not able to implement fully the battalion AAR guidelines during the SIMUTA Project, the SIMUTA-B Team decided to modify the AAR preparation and conduct procedures. The intent was to create more structure, allowing the O/Cs to focus more easily on task performance during AARs. Accomplishing this objective required the modification of a number of existing TSP products, including task lists, performance observation forms, and THP forms and procedures. This section describes the modifications made to the entire performance observation and feedback system by presenting both the old and new systems. In this report, the authors will describe only the Janus battalion training; there are few TSP differences between the Janus and SIMNET battalion training programs that pertain to the presently discussed modifications.

Original VTP Performance Observation and Feedback System

Explaining the observation and feedback system requires descriptions of the content and usage guidelines of task lists, observation forms, AAR preparation and conduct procedures, and THP preparation forms and procedures. The following presents the guidelines for executing the original VTP performance observation and feedback system used in Janus battalion staff exercises.

Observing performance during exercise. During the conduct of an exercise, the VTP O/Cs observed and recorded unit performance through the use of observation forms which were used in concert with task lists. The observation forms contained space for O/Cs to record observations, critical subtask references, and the times at which observations were made. O/Cs referenced task lists which helped them identify task performance. The task lists contained FM and ARTEP-MTP tasks which were reworded to correspond to specific exercises. Furthermore, the tasks were categorized into a number of groups, representing functional areas (i.e., command and control, coordination and dissemination of information, control of direct and indirect fires, and reporting).

Preparing for and conducting AARs. At the conclusion of an exercise's execution, the Senior O/C instructed subordinate O/Cs regarding which events to emphasize during their section AARs. In addition, the subordinate O/Cs briefed the Senior O/C on their observations and conclusions, and provided him with copies of their observation forms. Next, subordinate O/Cs conducted their AARs and briefed the Senior O/C on any important discoveries made. Section AARs were relatively informal, but did require the O/C to review the training objectives and intent, summarize the events, discuss critical subtask performance, and identify areas in which units should either sustain or improve their performance. Finally, the Senior O/C conducted the consolidated battalion AAR. During this AAR, the Senior O/C reviewed the tasks, plan, and enemy plan; provided a battle summary; discussed critical subtasks; and conducted a sustain and improve discussion.

Preparing the THP. After a unit had completed their VTP training, the O/C Team constructed a THP for the unit. The THP consisted of four parts: Critical Subtask THP Forms, the Observer's Section Summary Narrative, the Staff Coordination and Supervision Review, and the Staff Effectiveness Estimate. The Critical Subtask THP Forms were virtual replicas of the O/C task lists, except that they contained room for comments about task performance. The Observer's Section Summary Narrative contained information regarding strengths to sustain, areas improved during training, and areas to improve. The Staff Coordination and Supervision Review contained a written narrative that focused on the supervision of the staff, intrastaff section communication, and interstaff section communication. The original TSP did not include a highly structured time line regulating the completion of the THP.

Revised VTP Performance Observation and Feedback System

Modifications to the tools and processes of the performance observation and feedback system were due to the SIMUTA-B Team's observation of a lack of focus on critical subtask

performance in VTP AARs[6]. The team estimated that there were three causes, including: (a) task list content and structure, (b) performance observation form structure, and (c) the means designated for providing feedback to higher level O/Cs. In the revised TSP, the SIMUTA-B Team addressed each of these factors to create a mechanism of functionally related tools and processes, including task lists, observation forms, and AAR and THP feedback systems and tools. In sum, the modifications to the original TSP were not extensive, but represented a further delineation of the existing process. The following presents an overview of the guidelines for executing the revised VTP performance observation and feedback system.

Observing performance during exercise. The new guidance specifies that VTP O/Cs observe and record performance on Observation Forms and AAR Summary Forms which are specific both to the exercise and the element being observed. The Observation Forms allow an O/C to track exercise flow and record performance data relevant to doctrinal tasks. The forms are organized by exercise segments and events. For each event, the forms provide a brief list of task numbers and associated critical subtasks/staff actions that are written so that they are specific to the exercise. The critical subtasks/staff actions describe the observed position's duties and responsibilities as indicated by the appropriate ARTEP-MTP. If more detail is needed, the observer can use the relevant ARTEP-MTP as a supplementary source.

The AAR Summary Forms provide the O/C with a vehicle to focus his/her observations so that he/she can receive and provide feedback to higher level O/Cs regarding the content of their AARs. They contain events corresponding to the events on the Observation Forms and critical activities that represent more global aspects of staff and unit performance, important for successful mission and task execution. Each critical activity is associated with an event or a set of events. The forms contain space for comments for each critical activity. When making notes on the AAR Summary Form, the O/C considers the relevant comments made on the Observation Form and judges how the content of those notes fits in with the higher level O/C's AAR needs.

Preparing for and conducting AARs. Upon the termination of the exercise, the Senior O/C sets a time schedule for the AARs and preparation activities using the AAR Preparation and Execution Schedule. The Senior O/C conducts a highly structured post-exercise briefing session. The session is designed as follows. First, the Senior O/C and the Senior OPFOR Controller provide a battle summary. Second, the Senior O/C directs the Main CP Section Observers to provide information from their AAR Summary Forms, and when relevant, their Observation Forms, to the Main CP Senior O/C and themselves. Finally, they obtain from the Main CP Senior Observer, CTCP Observer, and Command Group Observer, notes from their AAR Summary Forms and Observation Forms. The entire process facilitates the upward flow of important information regarding critical subtask performance.

When the post-exercise briefing session is complete, the lower level O/Cs conduct their AARs and follow with a brief to the Senior O/C on any important discoveries made. The Senior O/C then conducts the consolidated battalion AAR using AAR slides that were developed by the VTP O/C Team. The feedback provided to the unit during the consolidated AAR focuses on the

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[6]All modifications to the performance observation and feedback systems and tools were completed in collaboration with the contracting agency, ARI-AFRU.

important aspects of the exercise, as delineated on the AAR Summary Forms, and allows the training unit to assess its strengths and weaknesses based on discussions of performance of ARTEP-MTP tasks cued during the exercise. All AARs are highly similar in structure to the original VTP AARs. The AAR preparation and delivery guidance provided in the revised TSPs, however, is more detailed.

Preparing the THP. The O/C Team still provides a THP to training units. The process of preparing the package is executed by the O/Cs who trained the unit and is overseen by the THP Coordinator. This package contains THP Critical Subtask Forms, THP Summary Forms, Observational Narratives, and a Battalion Task Force BOS Review. On the first two form types, the O/Cs transfer appropriate information from the Observation Forms and AAR Summary Forms, respectively. In the Observational Narratives, they provide their recommendations of strengths to sustain, areas improved, and areas to improve. The contents of the Observational Narratives should be supported by the Observation Forms and AAR notes. Finally, the Senior O/C composes the Battalion Task Force BOS Review. It represents his/her estimates of the unit's performance, on each BOS, in terms of areas in which the unit should sustain and improve performance. The BOS Review content originates primarily from the consolidated AAR sustain and improve discussion. The Senior O/C can also glean information from any of the data collection forms used during the exercise. The TSP contains a detailed schedule of the activities necessary to complete the THP.

To summarize, the performance observation and feedback system is a systematic process that facilitates the communication of information relevant to a unit's task performance. Each tool is an integral and important part of the process as a whole. See the Lessons Learned section for further information on the subject.

Lower Echelon Matrix OPORDs

The only important modification made to the company team and platoon TSP, other than the revised structure, was a change to the format of the narrative/OPORDs. The change was devised by the SIMUTA-B Team, but required the input of the project's steering committee, including ARI. The narrative/OPORDs contained in the original TSP represented narrative versions of a doctrinal five paragraph field OPORD. The SIMUTA-B Team manipulated that format so that the OPORDs took the form of full doctrinal five-paragraph field OPORDs for company team exercises, and matrix OPORDs for platoon exercises. The Lessons Learned section of this report provides more detail regarding the reasons for this modification.

Reactions of the VTP O/C Team

The reaction of the O/C Team to the new performance observation and feedback system can be best be described as a display of uncertainty. The system, to this point, has not been fully implemented. In general, O/Cs still use their own methods of data collection, and necessarily, preparing for AARs. On the other hand, the O/Cs were pleased with the new format of the company team and platoon OPORDs. In fact, they were one proponent of the modification. The reactions are discussed in further detail in the Lessons Learned section.

LESSONS LEARNED

The recent push by the U.S. Army to develop and sustain SST programs has elicited the need for SST developers to document lessons learned. This report is organized and written to support this aim.

The intended audience includes: (a) training program developers; (b) training development team designers; (c) training program sponsors who allocate funding for training programs and dictate training program objectives and goals; (d) U.S. Army leadership; and (e) training implementers (e.g., the VTP O/C Team) who maintain and improve the quality of the programs, once implemented.

Appendix D contains a synopsis of the lessons learned, which are couched under the following topics:

1. The acceptance of the SST concept.

2. Training program objectives and focus.

3. Administrative and team building issues.

4. Developmental issues.

Acceptance of Structured Simulation-Based Training Within the U.S. Army

One of the most important lessons states that, to successfully develop and implement an SST program, the Army must provide education regarding the benefits of SST and how it should be implemented.

In only their third year of existence, the VTP O/C Team likely represents the Army's most knowledgeable and premier implementor of structured training. During the initial development of the VTP, however, SIMUTA training developers observed the effects of the Army's lack of understanding of how to implement SST. First, developers observed that training units blamed poor performance on so-called "tactical deficiencies" in the VTP's mission scenarios and OPORDs. This created competing interests between justifying less than perfect performance and focusing on improving performance. Second, the VTP O/C Team did not consistently implement the VTP's building block concept of crawl-walk-run execution style. They sometimes manipulated table difficulty levels, which may have resulted in degraded performance in "crawl" and "walk" exercises that were intended to build unit confidence. Third, battalion-level AARs tended to focus on tactical outcomes rather than on task performance.

In effect, the benefits of SST can only be achieved to the extent that the training is implemented as designed. If this is the case, the benefits are numerous. They include: (a) achieving a focus on specific training objectives and tasks; (b) helping units increase their ability to perform more difficult tasks, via the crawl-walk-run design; and (c) allowing units to prepare quickly.

The SIMUTA-B Team took one step toward improving the Army's understanding of SST by redesigning the VTP's Orientation Guide. The team added an explanation of how to use SST, as provided by the VTP, and the benefits that can be attained. An ARI representative provided the explanation to be included in the Orientation Guide.

The authors recommend that the Army focus on improving their understanding of SST. Efforts to this end should affect, in a positive manner, the readiness levels of its units. Indeed, SST programs have been estimated to be effective in improving task performance (Hoffman et al., 1995; Koger et al., 1996; Shlechter et al., 1995).

Training Program Objectives and Focus

Many of the lessons learned during the course of the SIMUTA-B Project relate to determining, in advance of training program development efforts, the focus and objectives of training programs. More specifically, they deal with determining the usefulness and appropriateness of training program objectives, as well as the consequences of directing that simultaneously developed projects be interdependent.

Matching Program Goals to Simulation Capabilities

Despite extensive documentation of the importance of this lesson (Hoffman et al., 1995; Shlechter, Burnside, & Thomas, 1987), it is continually violated. Those who control or influence training program objectives and goals should research and evaluate the fit between project objectives and the designated simulation systems. This may require consulting independent military advisors and training development specialists.

In the SIMUTA-B Project extension, ARI stipulated that the development team create scout platoon exercises for the VTP's new DATK mission. The requirement was subsequently dropped, however, due to a lack of funding and the SIMUTA-B Team's assertion that the exercises would offer limited training benefit. The estimated lack of training benefit results from the fact that, in DATK missions, scouts are commonly stationary in their role as information providers. This negates the "fire and maneuver" training emphasis that SIMNET best provides. In addition, the VTP already contains scout exercises that address the same tasks as would be addressed in DATK scout tables.

In the end, the proposed allocation of resources to the development of scout platoon exercises was inconsequential. The outcome, however, could well have been different. The application of this lesson is important. Failing to estimate accurately the appropriateness of training program objectives could result in expenditures of time, energy, and funding that could be better spent elsewhere.

The Effects of Interdependence Among Simultaneously Occurring Development Efforts

This lesson is not unique to the SIMUTA-B Project, but has been documented by Koger et al. (1996) and Winsch, Garth, Ainslie, and Castleberry (1996). The lesson states that

organizations that designate training program objectives should carefully consider the value and feasibility of tying together the efforts of two or more concurrently developed programs.

As a case in point, the SIMUTA-B Project was directed to make its exercise story lines congruent, in terms of METT-T, with the story line composed by the SIMBART and FXXITP COBRAS projects. This directive initially appeared as feasible because the SIMBART Project began several months before the initiation of the SIMUTA-B Project. It was estimated that the SIMBART story line would be relatively stable by the time the SIMUTA-B Project would require it. Unforeseen delays in the SIMBART development process, however, complicated the situation, as the SIMBART Team was forced to make numerous revisions in scenario design. The revisions filtered down to the SIMUTA-B scenario and delayed the development process on several occasions. For example, changes in the brigade sector boundaries necessitated changes in the battalion sector boundaries used in the SIMUTA-B exercises. As a result, the SIMUTA-B battalion exercises had to be revised.

In the end, the SIMUTA-B effort was not irreversibly harmed; most of the deadlines were met and the goal of congruence was achieved. This outcome, however, may not be representative of future situations. The application of this lesson is the responsibility of those who control or influence the assignment of training program objectives. These organizations and individuals should make special efforts to predict possible complications resulting from linking project development efforts, and make decisions accordingly.

Exporting Exercises To Remote Sites

Before deciding that a training program should be exportable to remote simulation sites, the decision makers should consider all aspects involved in doing so. One primary consideration is the capability of the simulation and simulation support systems of the remote site to support the training developed for the primary site.

The SIMUTA-B Team designed the DATK company team and platoon exercises so that a training unit can execute the mission within the context of a simulated battalion. The purpose was to allow the training unit to focus on as many tasks as possible. For instance, to train a company to breach properly, the company should be able to maneuver and fight interactively with the remainder of their battalion. They should receive support from the other companies after they have completed the breach. Otherwise, they are only learning to move through an obstacle and fight in isolation. The SIMUTA-B Team judged that using ModSAF vehicles to replicate the majority of the BLUEFOR battalion would provide the most realistic training environment. This required at least two ModSAF workstations.

Although the SIMUTA-B Team has not attempted to export the exercises to remote sites, the lack of available ModSAF workstations at these sites could represent the need to consolidate the entire battalion on a smaller number of workstations. This may lead to frequent workstation overloads. The likely solution will be to reduce the vehicle (ModSAF entity) count. Consequently, the exercises will have a reduced realism, providing training units with a less than perfect environment in which to train some tasks.

One of the U.S. military's objectives is to distribute simulation-based training to the extent possible. It is also important, however, to understand the limits of what can be distributed and work within those limitations. Otherwise, funding may be allocated to projects that distribute training, but that do so at the expense of the training's utility.

Achieving a Focus on CSS Operations

Throughout the history of the VTP, the program's implementation has lacked sufficient focus on CSS operations. This finding was documented by SIMUTA-B developers, and was accented by training units who reported that they were not able to focus on CSS as much as they had desired. The lesson states that the goal of providing ample training on CSS operations can only be achieved by designing training that forces the conduct of such operations.

There are two factors that minimize the focus on CSS operations during VTP SIMNET battalion exercises. First, units become "simulation-fatigued" towards the end of these exercises. As a result, exercises are often terminated before the conduct of reorganization activities has been achieved. Although some CSS tasks are not practiced, the effects are not all bad. Units who execute shorter exercises can execute a greater number of exercises. The fact remains though, that the units do not receive robust training on CSS operations, which generally follow the execution phase in VTP exercises. Second, conducting many CSS tasks requires the continuance of an exercise, even after the maneuver units have completed their training objectives. In such cases, vehicle crew-level personnel must await the completion of staff activities before they can begin the next exercise; much of their time is not used efficiently.

Both factors are symptomatic of a poor match between training program design and the stated training program goals. In the SIMUTA-B Project, developers were directed to include CSS operations in the battalion training. They were also directed, however, to design exercises that would be independent in terms of a unit's operation state (OPSTATE). That is, each exercise was to provide an initial BLUEFOR OPSTATE unrelated to the results of any previously executed exercise. If a unit performed poorly in one battalion exercise, it would not influence the state of the unit at the initiation of the following exercise. In fact, these directives are not mutually supporting. If training is to focus on the conduct of CSS tasks, it should either require the conduct of CSS tasks in preparation for exercises, or require the conduct of CSS tasks during the first phase of an exercise. Both of these options force units to conduct CSS tasks.

The application of this lesson must occur during the time frame in which a project is conceptualized and designed. Achieving a focus on CSS requires more than the development of a tactical scenario that will generate CSS functions; it requires consideration of how the conduct of CSS functions will affect other training objectives.

Administrative and Team Building Issues

There is a great deal to be learned about coordination and team building issues from the following lessons learned. Projects that establish good communication channels and are composed of the proper personnel have a distinct advantage over others that lack these qualities.

Training Development Team Composition

Most of the lessons learned regarding the composition of SST development teams can be generalized to contexts other than SST program development. The intended audience includes anyone who is responsible for creating a team. The lessons focus on previous experience levels of military SMEs, SME expertise requirements, and continuity between program development teams in terms of personnel.

Experience Levels of Military SMEs

SST development teams should be composed of military SMEs who possess a variety of experience levels. In the realm of SST development, this lesson is intended for teams that are developing exercises at multiple, battalion, or higher echelons.

In the SIMUTA-B Project, the team was originally to develop only battalion exercises. Even so, they created a team of military SMEs who had attained ranks ranging from the upper noncommissioned officer levels, to Major. Including personnel who had attained a variety of ranks was beneficial because each was able to contribute to the development of different portions of the exercises. For instance, an SME who had recently completed the Armor Officer's Advanced Course was able to offer different insights than others who had completed the course many years earlier. This was true because, as doctrine changes throughout the course of time, certain knowledge becomes outdated. It was also true because SMEs who had recently completed the course retained more knowledge of course content.

In many fields, it is beneficial to mix old and new blood. Creating such a mix allows for the introduction of new ideas and techniques, which are consequently transfused throughout the entire team. The application is simple: variety is beneficial. This is especially true for teams whose goal is to develop military training at higher or multiple echelons.

Military SME Expertise Requirements

Ironically, military SMEs who develop SST do not have to be tactical "wizards" or "experts." This insight was gained through the experiences of both the SIMUTA and SIMUTA-B Projects. At the conclusion of an SST project, however, SMEs should be much more representative of "experts" than when the project began.

During the SIMUTA Project, SMEs reported that they were able to learn more about tactics and doctrine than during their military careers (Hoffman et al., 1995). The task analysis, simulation filtering, and scenario development processes conducted during the SIMUTA Project required that SMEs read and study the doctrinal manuals in a more detailed fashion than they had in the past. It became apparent to the SMEs that becoming an expert was much a matter of having the time to learn the material. The provision of such time was driven by the requirement to design doctrinally and tactically sound training. The same phenomenon was observed during the SIMUTA-B Project, reinforcing the observations made during the SIMUTA Project.

This lesson is intended for individuals who select the staffing for SST development teams. Again, one does not have to find the most knowledgeable persons, they have only to find persons of reasonable expertise, who have the motivation and experience-based capacity to learn more.

Continuity Between Projects in Terms of Personnel

Occasionally, as in the case of the SIMUTA-B Project, a development team 's objective will be to modify or expand an existing training program. These teams, if possible, should contain personnel who assisted in developing the original program.

The SIMUTA-B Team, whose goal was to modify and expand the VTP, was heavily weighted with persons who had developed the original VTP training. This proved to be very beneficial. First, the staff was already familiar with the existing program. Second, even before the SIMUTA-B Project had begun, these persons had formulated ways in which the program could be improved. During the SIMBART Project, developers used the phrase, good idea cut-off points (Koger et al., 1996). This phrase was descriptive of situations when developers thought of better ways to do things, but did so after it was too late to make the changes. Although good idea cut-off points still occurred in the SIMUTA-B Project, the effects on the training developed during the SIMUTA-B Project were reduced because of the staff's experience with the original SIMUTA development effort.

The application of this lesson is limited to the creation of teams whose objectives include modifying existing programs. Attaining personnel who are familiar with the program being modified saves time during the early stages of the project. In addition, these personnel usually will come pre-equipped with ideas regarding how to improve the program.

The Importance of Establishing Reliable Points of Contact

Many of the difficulties experienced during the SIMUTA Project were related to the lack of coordination between the SIMUTA and VTP O/C teams. The solution implemented during the SIMUTA-B Project was to establish a single point of contact (POC) from the O/C Team. This solution was consistent with the recommendation in Hoffman et al. (1995) that time for coordination must be scheduled.

The single POC strategy was generally effective. The only problems resulted from three factors. First, the initial O/C POC was not delegated the full authority to make decisions. This problem was later resolved. Second, the O/C Team's busy schedule affected the timely provision of feedback to the SIMUTA-B Team. Finally, the first two POCs were transferred out of the VTP O/C Team during the course of the project. Although new O/Cs were assigned to the position, the changes resulted in a loss of continuity in terms of relationships and knowledge of the development history.

For future projects in which development teams must work closely with military training teams, the SIMUTA-B Project offers substantial evidence that the single POC mechanism is an effective means of coordination. It minimizes the opportunities for miscommunications and simplifies the process of making timely decisions in which both parties are involved.

When to Involve Military Trainers in the Development Process

This lesson learned relates to the guidance in C. H. Campbell et al. (1995) that naive trainer teams should not be involved in the first dry run test of an exercise using live players. The lesson learned during the SIMUTA-B Project is that the guidance is good, but may be unattainable. That is, developers may not have a sufficient number of exercise participants without acquiring the assistance of the trainer team. Even when conducting a tryout with the sole purpose of collecting mechanical data, and not reactions or expert reviews, there appears to be no major consequence to violating the guidance. This lesson is intended for training developers, training implementors, and training program sponsors.

Because of a lack of available developer personnel, the VTP O/C Team assisted in the initial pilots of the Janus staff exercises. During these pilots, some O/Cs employed their own tactical preferences which resulted in pilots that did not test the intended tactical specifics of the exercises as designed. On the other hand, the feedback received from the O/C Team was valuable to the development effort. The O/Cs realized that the developers were still in the early stages of the development process, and did not attempt to influence, unduly, the course of development. In addition, even though the O/C Team had problems with the designed tactics, the SIMUTA-B Team judged that it was better to gain feedback of this nature early, rather than later. In sum, the estimated negative consequences of prematurely exposing the O/Cs to not yet fully developed tactics turned out to be unfounded. Furthermore, including the O/Cs was consistent with the lesson learned during the SIMUTA Project. Hoffman et al., (1995) recommended involving the O/C Team as early as possible, but in a controlled fashion, which would alleviate confusion, miscommunication, and the adverse consequences of such. Finally, it is important to note that trainers who are involved early in the development process assume the role of developers rather than of trainers.

In the overall scheme of SST program development, this lesson could be interpreted as applying only to those involved in the development of exercises that require large numbers of participants. This is probably not the correct interpretation. Even in less resource intensive situations, involving the training implementors in the first dry run can increase the likelihood that the they will accept the tactics employed in the exercises. Perhaps the real lesson to be learned is that whether or not to involve trainers early in the development process depends most heavily on the relationship between the developers and the trainers. Therefore, establishing good interteam relationships, and defining role responsibilities and limits are of extreme importance.

Development Issues

Many of the lessons learned during the SIMUTA-B Project are relevant to those who will develop future training programs. The lessons that follow relate primarily to factors that should be considered during the development of such programs. The last lesson focuses on the externally controlled process of simulation system revision.

The Pitfalls of Achieving Doctrinal Perfection

It is always preferable to achieve perfection; or so it seems. In the case of designing OPORDs for SST programs that provide turn-key training, striving to create perfect OPORDs may actually result in training utility decrements. Training developers should consider the following discussion which portrays an example in which attempted perfection decreased the effectiveness of an exercise.

In developing the original SIMUTA battalion DIS OPORD, developers created an extensive scenario and OPORD. In fact, the OPORD was so complicated, that processing it exceeded the resources of the intended training audience, the RC. This was evidenced by comments of a unit who executed the exercise during the course of the VTP development. They said that the exercise was complex to the extent that it required more time to understand than they had to give.

The SIMUTA-B Team addressed the above comment as a result of the requirement to make the DIS exercise congruent with the divisional brigade AD exercise created during the SIMBART and FXXITP COBRAS projects. Although there were no trials of the new DIS exercise during the SIMUTA-B Project, the developers have reason to believe that the new OPORD will require less time to understand and learn. In making the DIS exercise congruent with the AD exercise, SIMUTA-B developers intentionally made attempts to reduce the complexity of the OPORD. The true test of their efforts can only be measured during future executions of the DIS exercise, which will necessarily occur beyond the time frame of the SIMUTA-B Project.

It is important to understand that this lesson learned is limited in applicability to cases in which training is designed for units who do not have an abundant amount of time to prepare. This makes the developers of SST programs that are based on the turn-key execution concept the primary audience for the present lesson.

Effective and Realistic Simulated Message Traffic

In SST programs, such as the VTP, providing higher and adjacent unit radio traffic enhances the realism of the training. This traffic can be used to coach the unit and to prompt the unit to perform tasks representing training objectives. Future training developers should be aware that, although they can script some traffic to cue task performance, the O/Cs must generate the spontaneous message traffic necessary to create a realistic training environment.

The message traffic from higher and adjacent units that was scripted by training developers provides the base traffic necessary to cue task performance. The scripted traffic was not intended to provide complete realism in terms of frequency and intensity. Indeed, variance in exercise course and unit performance, especially in SIMNET, precludes the scripting of all message traffic. O/Cs should supplement and elaborate on the scripted message traffic based on their own tactical expertise and exercise course. If traffic from higher and adjacent units is not realistic in terms of frequency and intensity, the unit will not have the opportunity to operate in a hectic environment, similar to what they would experience during a real battle situation.

The value of an SST program depends on more than just the quality of the tactics and trainee motivation. It also depends on the trainers' willingness to go the extra mile to provide the realism necessary to make the training unit's experience as realistic as possible. A unit that trains under stress, but within the confines of amounts that will not hinder the learning process, will be more likely to handle the stress inherent in the situations for which they are training.

Achieving Training Efficacy in the OPORD Domain

This lesson pertains to the SIMUTA-B Team's modification of VTP company team and platoon OPORDs from a narrative to a full five-paragraph and matrix format. The lesson learned is intuitive. It states that the efficacy of training programs can be increased by creating training that requires the training audience to conform to Army standards.

The VTP is based on the turn-key concept. This concept allows RC units, who do not have a great amount of available training time, to focus only on execution rather than the plan and prepare phases. The concept is in part achieved through the existence of the program's prepared company team and platoon OPORDs. In the absence of these OPORDs and the turn-key format, unit commanders would have to prepare their own OPORDs. They would be intimately familiar with their OPORDs and would be readily able to communicate their intent and plan to their subordinates. Being that this is not the case, the original VTP OPORD formats are of a narrative nature. The narrative format compensates for the fact that unit commanders, because of time limitations, do not have time to become familiar with a full five-paragraph OPORD and translate the important aspects to their subordinates. The narrative format allows commanders to accomplish this task by just reading the narrative.

On the other hand, Army schools and CTCs require companies to prepare written five-paragraph field orders. The requirement for platoons is less stringent, but the five-paragraph field order format is still required, as it is the doctrinally correct way of preparing battle plans. In the context of field training, however, platoons typically do not have the time or personnel to prepare full five-paragraph field orders. This is especially true for RC units. One solution for platoons is to prepare orders in an execution matrix format. This format focuses on the actions required to execute an operation, while leaving out unit standing operating procedure information. This makes the order simpler and more easily understood. Matrix orders are an accepted alternative way of presenting orders at Army schools and CTCs. For more information on execution matrices, see FM 71-1 (DA, 1988e) or FM 71-2 (DA, 1988d).

It is appropriate to mention that the VTP O/C Team and units who executed the newly formatted OPORDs were extremely receptive to the new formats. The O/C Team remarked that the units were receiving better training than they did when they executed the more narrative-like OPORDs developed during the SIMUTA Project. The units commented that the new OPORD formats were easy to use and provided an opportunity to work with OPORDs that met accepted Army standards.

The application, while appearing to be extremely specific, is actually broad. In the domain of SST program OPORD development, OPORDs should balance the need to conform to Army

standards and training program objectives. In reality, the lesson can be applied in many other domains, such as mission complexity and task organization.

Improving Battalion AAR Effectiveness

In SST programs, the preparation for and conduct of AARs by O/Cs are critical factors in ensuring training efficacy. At their best, they facilitate an understanding, on the part of trainees, of how to improve task performance. O/C teams should be provided a well-defined process for preparing and executing AARs. Such a process should be time-efficient and facilitate the processing and communication of performance information. The process should be validated, and upon such, implemented (see Winsch et al. [1996] for a discussion of the importance of a standardized AAR system).

During the SIMUTA Project, training developers noted that battalion AARs were not focusing on task performance, as had been designed. As some of these developers were part of the SIMUTA-B Team, the SIMUTA-B Team acted on these observations. In re-examining the TSP, the team found that the original VTP TSP provided a relatively unstructured system for the provision of subordinate unit performance, by subordinate O/Cs, to senior O/Cs for higher echelon AARs. As implemented, the Senior O/C met with the group of O/Cs to review the battle. He asked for performance feedback from relevant O/Cs at given points in the meeting. The Senior O/C then processed the information and presented the AAR. Unfortunately, the topics covered in the AAR reflected the inability of the feedback system to yield task performance information. That is, the Senior O/C could usually focus on little more than tactics.

The SIMUTA-B Team estimated that giving more structure to the task performance feedback system would help the O/Cs focus on task performance during AARs. They created a systematic method for preparing and conducting battalion AARs. Unfortunately, the new system was not tested. The project occurred during a time when the VTP O/C Team was experiencing a transition in all levels of personnel. In addition, the tryout and product delivery schedule was tight. New O/Cs were hard-pressed to learn the tactical content of the exercises and the VTP's training concepts in preparation for the tryouts. During the battalion exercise tryouts, most O/Cs relied on 3X5 cards to record observations, which meant that they did not use the structured data collection instruments developed to enhance AAR preparation.

This lesson learned is intended specifically for those involved in the development of future SST programs. The developers, sponsors, and stakeholders must be able to prompt the testing of a structured AAR preparation and delivery system before the development process is complete. The VTP's implementation at Fort Knox could be improved if an organization, such as the Armor School, would assume responsibility for validating the training techniques and enforcing implementation in accordance with design. Finally, the relationship between such a system's successful implementation and the U.S. Army's acceptance of the SST concept is of extreme importance.

Performance Observation and Cognitive Limitations

Earlier, the authors presented descriptions of observation tools that facilitate information processing for feedback purposes. The lesson learned did not result from the development of the tools, but in the development of the tools. The lesson states that SST developers should consider the cognitive demands required to process performance observations and provide feedback. They should then design a system that minimizes those demands. The result should yield an effective and efficient system.

The cognitive demands required to process unit performance data are represented in the literature focusing on the difficulty of processing configural information. Research has shown that processing configural information is indeed a complicated and difficult process (Einhorn, 1971). Furthermore, Edgell (1980) found that the difficulty of processing such information increases as the amount and complexity of the information increases.

Information is configural when two or more interacting pieces of information must be processed to determine or predict an outcome. Observations of the performance of all the tasks that contribute to battalion-level mission performance represent configural information. That is, mission performance cannot be determined based only on the observation of one or more tasks in isolation. Hence, an O/C tasked with providing feedback on mission performance during a battalion exercise has a formidable job. The O/C must consolidate a great amount of inter-related information. Furthermore, because any one O/C can observe only a limited number of activities, O/Cs have to collaborate to determine which specific shortcomings are responsible for determining overall mission performance. This requires a system by which O/Cs can transfer performance information among themselves.

The performance observation and feedback system designed by the SIMUTA-B Team provides just that. In the system, each VTP O/C is responsible for observing only a subset of activities that occur within the context of the entire exercise. The performance observation tools (i.e., critical subtask observation forms) help them focus on the execution of the specific tasks they have been assigned to observe. Other tools (i.e., AAR summary forms) make them aware of the task performance information that they need to share with other O/Cs to facilitate the conduct of higher-level AARs. The AAR summary forms also facilitate the transfer of this information. The observation and feedback process is systematic, as described earlier, but it is also efficient considering the large amount of information to be processed.

This lesson is intended for training developers of SST programs who are tasked to design battalion or higher echelon training. Because the feedback process is so important in programs of this nature, the developers should spend the time necessary to create an observation and feedback system that will do justice to the efforts spent on designing other aspects of the training. Learning a little about how to circumvent the problems inherent in processing large quantities of configural information will serve them well.

Maximizing the Utility of Written Instruction

There are two lessons learned that relate to improving the utility of written instruction, such as the training guidance provided in the VTP TSPs. The lessons are based on findings showing that information presentation style and organizational structure are important factors in determining the effectiveness of written instruction. Although the lessons are not profound, they do deserve the attention of developers of future SST programs.

Structured Writing

Recently, the U.S. Army has taken a number of steps to standardize the content of SST program TSPs. The present lesson learned relates not to the content, but to how the content is presented. Specifically, presenting training guidance information in a structured writing format increases its utility. That is, instruction that is well organized, concise, and easy to read increases the willingness of prospective readers to read it.

Early in the SIMUTA-B Project, developers noticed that the new members of the O/C Team were not conducting the training according to design. The reason was interpreted as being that the O/Cs were not reading and/or processing the guidance provided in the TSPs. Either way, there was a problem to be addressed. Hence, developers introduced the concept of structured writing in the TSPs. In addition to the observed need for a way to increase the utility of the TSPs, the SIMUTA-B Team came across a recommendation in the TRADOC Regulation 25-34 (DA, 1993b), in which TRADOC encourages the use of structured writing for preparing TRADOC administrative publications, such as TSPs. Together, the need and the recommendation constituted a formidable reason to rewrite the TSPs in a structured writing format.

The benefits achieved are best framed in terms of the O/C Team's response to the modification. After having had a chance to review the revised TSP, the O/C Team reported to SIMUTA-B personnel that they liked the new format. They said it was easier to read and understand. During subsequent executions of SIMUTA-B platoon exercises, developers observed that new O/Cs who had never seen the old TSP versions were implementing training in closer correspondence to the guidance provided than had any O/Cs in the past. Almost every aspect of the O/Cs' implementation of platoon exercises (e.g., conducting detailed exercise previews for units, focusing on task performance during AARs) conformed to design specifications.

The lesson learned regarding the value of structured writing can be applied to any program that presents written instruction. Although reformatting the information may be time consuming, the benefits achieved should justify the means.

TSP Volume Structure

During the SIMUTA-B Project, developers reorganized the multi-workbook TSP structure that was created during the initial development of the VTP. The observed benefit of the TSP reorganization effort solidifies the following lesson's status as a lesson that can be applied to

virtually all future military SST programs. The lesson states that SST programs should always be designed so that expansions can be accomplished without destroying the original product.

Recall that one goal of the SIMUTA-B Project was to expand the VTP battalion exercise library by adding three new battalion exercises. The existing VTP TSP structure, however, did not lend itself to that goal. For instance, adding a new mission would have created the need to modify every workbook and guide in the TSP. Thus, developers chose to revamp the battalion TSP, in terms of its organization, to avoid creating an unwieldy set of materials that would be difficult to manage and expand. The modifications made are described earlier in Table 2.

The main benefit of the reorganization is that it allows for future expansions of the VTP battalion TSP. Training developers can add any number of new exercises while having to make a few modifications to the existing TSP's content. Specifically, they will only have to create the new exercise volumes, and add small amounts of information regarding the new exercises to the Training Guide, the Unit Exercise Materials volume, and the Orientation Guide. The latter additions do not represent major efforts. Another benefit is represented in that the new organizational structure facilitates revisions prompted by periodic doctrinal updates.

As stated above, the lesson learned is that SST TSPs should be designed in consideration of the occurrence of future expansion efforts. Doing so makes it easy for training developers and military trainers to expand training programs.

Modifying SST Programs

Because of the complexity inherent in SST, those tasked with maintaining the currency of, or even improving the program, must insure that they have a complete understanding of how the program components interact to produce a consolidated training mechanism.

It is difficult to modify any individual component of the VTP without undermining the concepts on which the training is based. The following discussion identifies some of these concepts and illustrates how modifying certain aspects of the program affect training value. First, the program is built on the "crawl-walk-run" concept in which units first practice easy tasks and then progress to more difficult tasks. Units whose skills are less than satisfactory should find this strategy beneficial. If, however, the force ratios are modified by the addition of additional enemy entities, the task difficulty progression becomes disrupted. Specifically, if more enemy forces are added to "crawl" exercises, they become "walk" or "run" exercises, which may be unnecessarily difficult for training units of lower readiness. Frustration at a lack of success may result.

Second, the VTP's SIMNET familiarization course is designed to prepare units specifically for the execution of VTP exercises. The familiarization course focuses on aspects of operating in the SIMNET environment that are key to VTP exercise execution. If the familiarization course is modified so that it does not address the necessary topics, units may experience difficulty with the simulation during training. Focus on task execution may be reduced because of problems with simulation idiosyncracies.

Third, the VTP OPFOR operations are highly structured in terms of actions taken. The structure provides predetermined cues for the execution of specific tasks. The concept of a "thinking OPFOR," which lacks realistic decision loops within which to operate and whose goal is to win the battle, is foreign to the VTP's charter. By playing this type of OPFOR, one runs the risk of eliminating cues and opportunities for task performance (Winsch et al., 1996). A more appropriate concept is represented by the phrase, "thinking-about-learning OPFOR." It is important to establish a positive learning environment with a generous window of success for the training unit. The OPFOR, then, is best described as a training tool, providing specified actions to cue task performance.

Fourth, the company team training is designed to provide AARs at the platoon and company team levels. The platoon AARs provide the building blocks which allow the company team O/Cs to focus on company-level issues. They are a forum for discussion of platoon and individual tasks which are important for vehicle commanders and crew members. If platoon AARs are not conducted, company team AARs may be forced to focus largely on platoon issues. Additionally, unless crew members attend the company AARs, they receive no AAR. In the VTP's original implementation, crew members said that the platoon AARs provided valuable feedback regarding individual proficiencies (Hoffman et al., 1995).

This lesson learned is for those responsible for modifying SST programs, and especially for trainer teams who have the freedom to vary how training is implemented. Before making modifications or varying implementation techniques, they should understand how the changes will affect the program's value. There is one circumstance that demonstrates how a properly made training program modification can increase the value of a program. Entirely new sets of exercises can be developed that incorporate certain aspects of new METT-T. For instance, the SIMUTA-B Team created a set of exercises based on a new mission. This addition to the exercise library did not violate the concepts on which the program was based; it only expanded the training available. Based on the fact that modifications of this nature produce far fewer risks than do others, they may be more preferable than other types of modifications.

Simulation System Design and Upgrades

The wide and ever expanding use of simulation systems to provide training for Army units elicits the following lesson. Simulation system developers must develop systems that take into account the nature and objectives of the training programs in which they will be employed. Discussion of the lesson is based on the SIMUTA-B Team's experiences with ModSAF.

The nature of the efforts to continually upgrade ModSAF has one major deficiency. Newer versions of ModSAF software have not been designed to allow for the easy transfer of exercises developed on older versions to the newer versions. This does not account for the Army's continued use of older versions of simulation technologies even after newer versions have been developed. The consequence relates to the SIMUTA-B Team's requirement to produce exercises that can be exported to remote sites. The inconsistencies between ModSAF versions made this process unnecessarily difficult.

This lesson is intended specifically for simulation system developers and those who designate the requirements they must meet. These individuals should not forget that the real utility of a simulation system is most dependent upon its interface with the goals and objectives of the training programs in which it will be employed.

Conclusion

The lessons learned contained in this report originated from observations made during both the SIMUTA and SIMUTA-B Projects. The task of the SIMUTA-B Project was to modify and enhance the VTP products created during the SIMUTA Project. Additionally, the two projects were linked in terms of personnel; several SIMUTA-B developers were a part of the SIMUTA effort. These factors facilitated the research-oriented goal of the development efforts by affording an excellent opportunity to implement and occasionally test the utility of the lessons learned during the projects. The lessons that were actually implemented during the SIMUTA-B Project focused on the following areas:

1. Creating a TSP structure that lends itself to the addition of new training exercises.

2. Presenting TSP guidance in a structured writing format to facilitate comprehension.

3. Designing a performance feedback system that takes into account the cognitive demands inherent in processing configural performance information.

4. Designing training that addresses the demands and techniques present in FTX and battlefield environments.

5. Developing relatively non-complex OPORDs that allow for a turn-key execution of training.

6. Developing a good working relationship with training implementors to generate a feeling of product ownership, and therefore acceptance, among implementors.

7. Establishing POCs for the developer and implementor teams.

8. Establishing consistency in terms of training developer personnel between related development projects.

9. Obtaining a mix of military SMEs in terms of amount of experience.

As is typically the case in development efforts such as the SIMUTA-B Project, there were a number of lessons learned during the project that could not be implemented and tested. It is incumbent on future training developers and others for whom the lessons are intended to evaluate the relevance and probable utility of these lessons before making the decision to follow their guidance.

SUMMARY

The purpose of this report was to document the activities and accomplishments of the SIMUTA-B Project and to present lessons learned. The report began by explaining the project's background and roots, from a historical perspective. It then progressed to a presentation of the project's exercise design process. In doing so, it documented the extent to which the SIMUTA-B Team was able to implement the SST development methodology (C. H. Campbell et al., 1995). The third section of the report described the formative evaluation efforts, providing information relating to the evaluation's focus, strategy, and methodological activities.

The results of the formative evaluation, along with a description of the developmental accomplishments achieved during the project, were included in the last two sections of the report, Training Development and Lessons Learned. The Training Development section provided information pertaining to accomplishments and problems encountered during the project. It also highlighted the nature of the feedback provided by the VTP O/C Team, which implements the training program, and units who tried out exercises. The report concluded with a presentation of the lessons learned. Although they were derived within the context of a specific environment, many can be generalized to different types of training development. Among others, these include the concepts of constructing a team of individuals of varying experience levels, promoting acceptance among training users, and accounting for the cognitive demands of processing configural information.

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Appendix A. Acronyms and Abbreviations

AAR	After action review
AC	Active component
AD	Area defense
AFRU	Armored Forces Research Unit
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ARNG	Army National Guard
ARPA	Advanced Research Projects Agency
ARTEP	Army Training and Evaluation Program
AT	Annual training
AXP	Ambulance exchange point
BLUEFOR	Friendly forces
BOS	Battlefield operating system
CCF	Critical combat function
COBRAS	Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation
CP	Command post
CS	Combat support
CSS	Combat service support
CTC	Combat training center
CTCP	Combat trains command post
DA	Department of the Army
DATK	Deliberate attack
DIS	Defense in sector
1SG	First Sergeant
FIST	Fire Support Team
FM	Field manual
FTX	Field training exercise
FXXITP	Force XXI Training Program
METT-T	Mission, enemy, troops, terrain, and time
ModSAF	Modular semi-automated forces
MTC	Movement to contact
MTP	Mission training plan
NTC	National Training Center
O/C	Observer/controller
OPFOR	Opposing forces
OPORD	Operations order
OPSTATE	Operation state
POC	Point of contact
RC	Reserve component
RCVTP	Reserve Component Virtual Training Program
SIMBART	Simulation-Based Mounted Brigade Training Program
SIMNET	Simulation Networking
SIMUTA	Simulation-Based Multiechelon Training Program for Armor Units

SIMUTA-B	Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion
SME	Subject matter expert
SOW	Statement of work
SST	Structured simulation-based training
THP	Take-home package
TRADOC	U.S. Army Training and Doctrine Command
TSP	Training support package
UPAS	Unit Performance Assessment System
VTP	Virtual Training Program

Appendix B. Standard Sources for Tasks

This appendix contains the Army Training and Evaluation Program (ARTEP) - Mission Training Plan (MTP) and Field Manual (FM) documents that represent the standard sources from which the deliberate attack exercise tasks were drawn.

1.	ARTEP 7-247-11-MTP	Mission Training Plan for the Mechanized Infantry Platoon and Squad (M2 Equipped) (Department of the Army [DA], 1987a)
2.	ARTEP 17-237-10-MTP	Mission Training Plan for the Tank Platoon (DA, 1988c)
3.	ARTEP 17-237-10-MTP	Mission Training Plan for the Tank Platoon (DA, 1995)
4.	ARTEP 71-1-MTP	Mission Training Plan for the Tank and Mechanized Infantry Company and Company Team (DA, 1988b)
5.	ARTEP 71-2-MTP	Mission Training Plan for the Tank and Mechanized Infantry Battalion Task Force (DA, 1988a)
6.	FM 7-7J	The Mechanized Infantry Platoon and Squad (Bradley) (DA, 1993a)
7.	FM 17-15	Tank Platoon (DA, 1987b)
8.	FM 17-15	Tank Platoon (Final draft version) (1996)
9.	FM 71-1	Tank and Mechanized Infantry Company Team (DA, 1988e)
10.	FM 71-2	Tank and Mechanized Infantry Battalion Task Force (DA, 1988d)
11.	FM 71-123	Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion Task Force, and Company Team (DA, 1992)

Appendix C. Virtual Training Program Deliberate Attack Exercise Task Lists

Tasks for the deliberate attack (DATK) exercises developed during the "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)" Project were extracted from the U.S. Army's Army Training and Evaluation Program (ARTEP) - Mission Training Plan (MTP) and Field Manual documents. Tables C1 through C5 include the final task lists for the two Janus battalion exercises, the Simulation Networking (SIMNET) battalion exercise, the company team exercises, the mechanized infantry platoon exercises, and the armor platoon exercises, respectively.

Table C1

Tasks and Reference Numbers for the DATK Janus Staff Exercises

Task number	Task title
7-1-3004	Move Tactically
7-1-3008	Attack by Fire
7-1-3027	Breach Defended Obstacles
7-1-3007	Assault
7-1-3023	Consolidate
7-1-3022	Reorganize

Note. Tasks were extracted from ARTEP 71-2-MTP (Department of the Army [DA], 1988a)

Table C2

Tasks and Reference Numbers for the DATK SIMNET Exercise

Task number	Task title
7-1-3004	Move Tactically
7-1-3008	Attack by Fire
7-1-3027	Breach Defended Obstacles
7-1-3007	Assault
7-1-3023	Consolidate
7-1-3022	Reorganize

Note. Tasks were extracted from ARTEP 71-2-MTP (DA, 1988a)

Table C3

Tasks and Reference Numbers for the DATK SIMNET Company Team Exercises

Task number	Task title
17-2-0201	Maintain Operation Security
17-2-0301	Perform Tactical Movement
17-2-0306	Support by Fire
17-2-0311	Perform an Attack by Fire
17-2-0401	Employ Indirect Fire in the Offense
17-2-0501	Breach an Obstacle
17-2-0304	Perform Actions on Contact
17-2-0326	Assault an Enemy Position (Mounted)
17-2-0402	Employ Indirect Fire in the Defense
17-2-0703	Perform Service-Station Resupply
17-2-0704	Consolidate on the Objective
17-2-0706	Reorganize on the Objective
17-2-1021	Defend

Note. Tasks were extracted from ARTEP 71-1-MTP (DA, 1988b)

Table C4

Tasks and Reference Numbers for DATK SIMNET Mechanized Infantry Platoon Exercises

Task number	Task title
7-3-4026	Change Formation (Mounted)
7-3-4024	Move Mounted
7-3-4058	Report
7-3-4007	Support by Fire
7-3-4038	Acquire Targets/Distribute Fires
7-3-4047	Consolidate and Reorganize
7-3-4021	Defend a Battle Position
Battle Drill 1A	Platoon Attack
Battle Drill 2A	React to Contact (Mounted)

Note. Tasks were extracted from ARTEP 7-247-11-MTP (DA, 1987a)

Table C5

Tasks and Reference Numbers for the DATK SIMNET Armor Platoon Exercises

Task number	Task title
17-3-1016	Conduct Tactical Movement
17-3-0209	Execute Traveling
17-3-0205	Execute a Wedge Formation
17-3-0207	Execute a Line Formation
17-3-0221	Execute Actions on Contact
17-3-0220	Assault an Enemy Position
17-3-0219	Conduct an Attack by Fire
17-3-3061	Conduct Overwatch/Support by Fire
17-3-3070	Conduct Breach Force Operations
17-3-0208	Execute an Echelon Formation
17-3-2601	Conduct Hasty Occupation of a Platoon Battle Position
12-3-C021	Conduct Consolidation and Reorganization
17-3-0601	Conduct Resupply Operations
Battle Drill 1	Change of Formation Drill
Battle Drill 2	Action Drill
Battle Drill 3	Contact Drill (Actions on Contact)
Battle Drill 5	React to Indirect Fire

Note. Tasks were extracted from ARTEP 17-237-10-MTP (DA, 1988c; DA, 1995)

Appendix D. A Synopsis of the Lessons Learned

Table D1 presents a synopsis of the lessons learned and documented during the "Simulation-Based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion (SIMUTA-B)" Project. For each lesson, it provides a descriptive title, the intended audience, and a brief statement of the lesson. The titles are descriptive only in the sense that they identify the area to which the lesson learned relates. The intended audiences include the following: (a) training program developers; (b) training development team designers; (c) training program sponsors who allocate funding for training programs and dictate training program objectives and goals; (d) U.S. Army leadership; and (e) training implementers (e.g., the Virtual Training Program Observer/Controller Team) who maintain and improve the quality of the programs, once implemented.

Table D1

A Synopsis of the Lessons Learned and Their Intended Audiences

Lesson Title	Intended Audience	Lesson
Acceptance of Structured Simulation-Based Training (SST) in the Army	U.S. Army leadership	Educate Army personnel as to the benefits of SST and how it should be implemented.
Matching Program Goals to Simulation Capabilities	Training Program Sponsors	Research and evaluate the fit between program objectives and simulations. Consult independent military advisors and training development specialists.
The Effects of Creating Interdependence Among Simultaneously Occurring Development Efforts	Training Program Sponsors	Pay careful consideration to the value and feasibility of creating a dependent relationship between two training programs that will be developed concurrently.
Exporting Exercises	Training Program Sponsors	Before determining that a training program should be exportable, consider the feasibility of doing so.
Achieving a Focus on Combat Service Support (CSS) Operations	Training Program Sponsors	To create training that focuses on CSS operations, the training design should force the conduct of CSS tasks.
The Value of Variation in Military Subject Matter Expert (SME) Experience Levels	Training Development Team Designers	SST developer teams should be composed of military SMEs who possess a variety of experience levels.
Military SME Expertise Requirements	Training Development Team Designers	Military SME training developers do not have to be tactical "wizards." They must only be of reasonable expertise and have the motivation and experience-based capacity to learn more.

Table D1, cont'd

A Synopsis of the Lessons Learned and Their Intended Audiences

Lesson Title	Intended Audience	Lesson
Continuity Between Projects in Terms of Personnel	Training Development Team designers	Projects intended to modify or expand existing training programs should be staffed by personnel who developed the program to be modified.
Establishing a Reliable Point of Contact (POC)	Training Developers, Training Implementors, and Training Program Sponsors	To establish an effective communication vehicle between training developer and implementor teams, each team should designate one reliable POC.
When to Involve Training Implementors in the Development Process	Training Developers, Training Implementors, and Training Program Sponsors	Training implementors should be involved early in the development of the training program they will implement.
The Pitfalls of Achieving Doctrinal Perfection	Training Developers	In the case of SST programs whose objectives are to provide "turn-key" training, striving to create the perfect operations order (OPORD) may actually result in training utility decrements.
Effective and Realistic Simulated Message Traffic	Training Developers and Training Implementors	In SST programs, training developers should script the appropriate message traffic to cue task performance, but training implementors must provide spontaneous traffic to create a realistic training environment.
Achieving Training Efficacy in the OPORD Domain	Training Developers	The efficacy of SST programs will be increased by creating training that requires the training audience to conform to Army standards.
Improving Battalion After Action Review Effectiveness	Training Developers, Training Implementors, and Training Program Sponsors	An SST program training support package (TSP) should include a well defined performance observation and feedback system that facilitates the processing and communication of information to maximize time and resources. The system must be tested during development.
Performance Observation and Cognitive Limitations	Training Developers	The cognitive demands required to process performance observations and provide feedback must be considered before designing a performance observation and feedback system.

Table D1, cont'd

A Synopsis of the Lessons Learned and Their Intended Audiences

Lesson Title	Intended Audience	Lesson
TSPs and Structured Writing	Training Program Sponsors and Training Developers	Presenting training guidance information in a structured writing format increases its utility.
TSP Structure	Training Program Sponsors and Training Developers	SST TSPs should be designed to facilitate future expansions.
Modifying SST Programs	Training Developers and Training Implementors	Because of the complexity inherent to SST programs, a complete understanding of the program components must be achieved before modifications are made.
Simulation System Design and Upgrades	Simulation System Developers and Training Program Sponsors	Simulation systems must be designed and upgraded in a way that takes into account the needs of the training programs in which they will be employed.